

that was to be used, and personally directed the lab technicians at PTLI as to the tests to be performed.

28. PTLI is accredited by the American Association for Laboratory Accreditation in the field of Mechanical Testing in accordance with the recognized International Standard ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories. PTLI is specifically accredited to perform the ASTM D2240 Durometer Hardness test.

29. I requested that PTLI conduct Shore D hardness measurements on the surface of the formed golf balls described above. Specifically the tests to be performed would be done in accordance with ASTM D2240, with the exception that the tests would be performed on the surface of the golf balls rather than on a plaque of material as required by ASTM D2240.

30. Prior to conducting the Shore D measurements, PTLI technicians conditioned the balls at 40+ hours at 23 degrees (+/- 2) Celsius and 50% (+/- 5%) Relative Humidity.

31. PTLI conducted Shore D hardness measurements on the balls I provided to them as I requested. For each ball specimen, PTLI took five readings on the Shore D scale between the dimples of the ball. For each ball specimen, these five readings were averaged. PTLI performed this process on all twelve samples of each ball construction, and provided for each ball construction an average Shore D hardness value for all twelve samples.

#### RESULTS OF TESTING

32. Each of the twelve ball specimens that were tested for each ball construction had an average cover hardness reading of below 64 Shore D. Each ball construction had an average cover hardness (over the twelve samples) of below 64 Shore D.

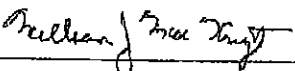
33. The following table sets forth the average Shore D hardness measurements (over the twelve samples) that were performed for each ball construction type:

Ball #	Core	Inner Cover Layer	Outer Cover Layer	Shore D
BALL_1	Nesbitt 193	Nesbitt 193	Molitor 637	62.0
BALL_2	Nesbitt 193	Nesbitt 193	Wu 673	56.0
BALL_3	Nesbitt 193	Nesbitt 193	Molitor 751	50.1 <sup>1</sup>
BALL_4	Nesbitt 193	Molitor 637	Molitor 637	61.0
BALL_5	Nesbitt 193	Molitor 637	Wu 673	55.6
BALL_6	Nesbitt 193	Molitor 637	Molitor 751	49.6
BALL_7	Proudfit 187	Proudfit 187	Molitor 637	59.4
BALL_8	Proudfit 187	Proudfit 187	Wu 673	56.8
BALL_9	Proudfit 187	Proudfit 187	Molitor 751	51.2

34. I am informed that PTLJ has retained the ball samples that it tested, and they remain available for further testing if necessary. I am also informed that PTLJ has retained the test results if needed.

I declare under penalty of perjury that the statements above are true and correct.

Date: May 29, 2007

  
 William J. MacKnight

<sup>1</sup> As I noted above, the outer cover layer material that was tested used a slightly harder Surlyn (1605, now 8940), than the Surlyn described in Example 4 of Molitor 751, so the hardness measurements using the outer cover layer material of Example 4 would be even softer than those set forth for Molitor 751 in this table.

# **EXHIBIT 32**

## Invalidity Charts for U.S. Patent No. 6,595,873

## NESBITT INCORPORATING MOLITOR '637

Claim 1	Nesbitt and Molitor '637
A golf ball comprising:	"The disclosure embraces a <b>golf ball</b> and method of making same ...." (Nesbitt, Abstract; FIGS 1 & 2.)
a core;	"Referring to the drawings in detail there is illustrated a golf ball 10 which comprises a <b>solid center or core</b> formed as a solid body of resilient polymeric material or rubber-like material in the shape of a sphere." (Nesbitt, col. 2, lines 31-34.)
an inner cover layer disposed on said core,	"Disposed on the spherical center or core 12 is a first layer, lamination, ply or <b>inner cover 14</b> of molded hard, highly flexural modulus resinous material...." (Nesbitt, col. 2, lines 34-37.)
said inner cover layer having a thickness of from about 0.100 to about 0.010 inches,	"It is found that the inner layer of hard, high flexural modulus resinous material such as Surlyn® resin type 1605, is preferably of a thickness in a range of 0.020 inches and 0.070 inches." (Nesbitt, col. 3, lines 19-23.)
said inner cover layer comprising a blend of two or more ionomer resins, at least one of which contains no more than 16% by weight of an alpha, beta-unsaturated carboxylic acid; and	<p><b><u>Nesbitt Incorporates the Materials of Molitor '637 by Reference:</u></b> "Reference is made to the application Ser. No. 155,658 of <b>Robert P. Molitor issued into U.S. Pat. No. 4,274,637</b> which describes a number of foamable compositions of a character which may be employed for ... layers 14 ... for the golf ball of this invention." (Nesbitt, col. 3, lines 54-60.)</p> <p><b><u>Molitor '637:</u></b> Molitor teaches, in examples 1-7, cover materials including a blend of two ionomer resins: Surlyn 1605 and Surlyn 1557. (Molitor '637, col. 14, line 22 to col. 16, line 34.)</p> <p>Type 1605 Surlyn® is now designated Surlyn® 8940. ('293 patent, col. 2, lines 54-55.) It has about 15% acid. ('293 patent, col. 2, lines 55-57.)</p> <p>Type 1557 Surlyn is now designated Surlyn 9650. (Ex. 25, DUP 000038.) It has an acid content of about 11%. (Ex. 26, DUP 000132.)</p> <p>Callaway admits that Nesbitt teaches the use of the ionomer blend found in Molitor '637 in a multi-layer golf ball. (See Ex. 24, Response to Office Action Mailed February 27, 2007 in Reexam. Cont. No. 95/000,120 at 16.)</p>
an outer cover layer disposed on said inner cover layer,	"An <b>outer layer, ply, lamination or cover 16</b> ... is then remolded onto the inner ply or layer 14...." (Nesbitt, col. 2, lines 43-47.)

## Invalidity Charts for U.S. Patent No. 6,595,873

Claim 1	Nesbitt and Molitor '637
said outer cover layer having a thickness of 0.010 to 0.070 inches,	<p>"The <b>thickness of the outer layer or cover 16</b> of soft, low flexural modulus resin such as Surlyn type 1855, <b>may be in the range of 0.020 inches and 0.100 inches.</b>" (Nesbitt, col. 3, lines 22-25.)</p> <p>"The outer layer of the soft resin is of a thickness of <b>0.0575 inches.</b>" (Nesbitt, col. 3, lines 39-40.)</p>
and said outer cover layer comprising a polyurethane material,	<p><b><u>Nesbitt Incorporates the Materials of Molitor '637 by Nesbitt Incorporates Materials of Molitor by Reference:</u></b>  "Reference is made to the application Ser. No. 155,658, of Robert P. Molitor issued into U.S. Pat. No. 4,274,637 which describes a number of foamable compositions of a character which may be employed for one or both layers 14 and 16." (Nesbitt, col. 3, lines 54-60.)</p> <p><b><u>Molitor '637:</u></b> Teaches cover materials including "polyurethanes such as are prepared from polyols and organic polyisocyanates"; specifically teaches Estane 58133 thermoplastic polyurethane. (Molitor '637, col. 5, lines 39-41; col. 18, lines 31-59 (examples 16 and 17).)</p>
wherein said golf ball has an overall diameter of 1.680 inches or more,	<p>"According to the United States Golf Association Rules, the <b>minimum diameter prescribed for a golf ball is 1.680 inches....</b>" (Nesbitt, col. 2, lines 50-52.)</p> <p>"This center or core 12 and inner layer 14 of hard resinous material in the form of a sphere is then remolded into a dimpled <b>golf ball of a diameter of 1.680 inches minimum</b> with an outer or cover layer 16 of a soft, low flexural modulus resin...." (Nesbitt, col. 3, lines 34-38.)</p>
said inner cover layer having a Shore D hardness of at least 60,	<p><b><u>Nesbitt:</u></b> "[I]nner cover 14 of molded <b>hard</b>, high flexural modulus resinous material such as <b>type 1605 Surlyn® marketed by E.I DuPont de Nemours.</b>" (Nesbitt, col. 2, lines 36-38.)</p> <p><b><u>Per the '293 Patent:</u></b> "Type 1605 Surlyn® (now designated Surlyn® 8940)." ('293 patent, col. 2, lines 54-55.)</p> <p><b><u>DuPont Surlyn® Product Information:</u></b> Surlyn® 8940 (formerly Surlyn® 1605) has an "off the ball" Shore D hardness of 66. ('293 patent, Table 1.)</p> <p><b><u>Nesbitt Incorporates the Materials of Molitor '637 by Reference:</u></b> "Reference is made to the application Ser. No.</p>

## Invalidity Charts for U.S. Patent No. 6,595,873

<p><b>Claim 1</b></p>	<p><b>Nesbitt and Molitor '637</b></p> <p>155,658 of <b>Robert P. Molitor issued into U.S. Pat. No. 4,274,637</b> which describes a number of foamable compositions of a character which may be employed for ... layers 14 ... for the golf ball of this invention." (Nesbitt, col. 3, lines 54-60.)</p> <p><b>Molitor '637:</b> Molitor '637 discloses a blend of two ionomers: Surlyn 1605 and Surlyn 1557. (Molitor '637, Table 1).</p> <p>Type 1557 Surlyn is now designated Surlyn 9650. (Ex. 25, DUP000038.) Surlyn 9650 has an "off the ball" Shore D hardness of 63. (Ex. 26, DUP000132.)</p> <p>The blend of Surlyn 8940 and 9650 has a Shore D hardness of 64.3 when measured off the ball. (See Ex. 29, "Blend 3", AC 0131414.)</p> <p>Measurements of Surlyns made "on the ball" are higher than "on the ball" plaque measurements and would thus also be above 60. Ex. 19, Nesbitt Depo. Tr. at 244:12—244:17.</p>
<p>and said outer cover layer having a Shore D hardness of less than 64.</p>	<p><b>Nesbitt Incorporates the Materials of Molitor '637 by Reference:</b> "Reference is made to the application Ser. No. 155,658 of <b>Robert P. Molitor issued into U.S. Pat. No. 4,274,637</b> which describes a number of foamable compositions of a character which may be employed for ... layers ... 16 for the golf ball of this invention." (Nesbitt, col. 3, lines 54-60.)</p> <p><b>Molitor '637:</b> Teaches the use of <b>Estane 58133</b> in Examples 16 and 17. (Molitor '637, col. 18.) Estane is a soft polyurethane material that has a <b>Shore D hardness of 55 as measured "off the ball."</b> (CW 00615792.)</p> <p>When measured <b>on the ball of Nesbitt</b> (using Molitor '637's blend of ionomer as the inner cover layer), Molitor '637's outer cover layer has a Shore D hardness of 61.0. (Ex. 31, MacKnight Decl. at ¶ 33.) When measured on the ball of Nesbitt (using Nesbitt's Surlyn 1605 as the inner cover layer), Molitor '637's outer cover layer has a Shore D hardness of 62.0. (<i>Id.</i>)</p> <p><b>Nesbitt:</b> Once the materials for the cover layers are selected, Nesbitt teaches the that each cover layer may be more or less foamed to achieve the desired "soft over hard" quality of the golf ball: "The inner, intermediate or first layer 14 on the core 12 may be preferably partially or only slightly foamed to a low degree so</p>

## Invalidity Charts for U.S. Patent No. 6,595,873

Claim 1	Nesbitt and Molitor '637
	<p>as not to materially affect the coefficient of restitution of the material. The outer or cover layer or second layer 16 may be foamed to a greater degree than the inner, intermediate or first layer 14 as the material of the layer 16 is comparatively soft." Nesbitt, col. 3:62-68. Nesbitt teaches that the outer cover, in particular, should have the same hardness as balata: "The soft Surlyn resin cover would have about the same thickness and shore hardness of a balata covered golf ball...." Nesbitt, col. 3:40-42. Balata covered golf balls have an "on the ball" Shore D hardness from the high 40s to the low 50s. <i>See</i> Ex. 15 AC0049407 (1990 Competitive Ball Report) ("all high performance products have a similar construction; balata cover ranging from 47-54 Shore D hardness"); AC0049409 (showing Titleist Tour 100 having transpolyisoprene (synthetic balata) cover with a Shore D hardness of 54); AC0049411-12 (showing Titleist 384 Tour 100 with balata cover with Shore D hardness of 53); AC0049415-416 (showing Titleist 384 LT 100 with balata cover with Shore D hardness of 47); Ex. 16 at CW00522703 (Spalding Memo Showing same); <i>see also</i> Ex. 17, 1991 Competitive Ball Report at AC0049683-84 (showing on the ball hardness measurements for numerous balata balls ranging from 48-54 Shore D); Ex. 18 (1994 Competitive Ball Report) at AC0072912, AC0072915, AC0072916, and AC0072945 (showing numerous additional balata balls with on the ball Shore D hardness values ranging from 50-52. Ex. 19, Nesbitt Depo. Tr. at 121:19-122:5 (testifying that Titleist balata-covered golf balls had an on the ball Shore D hardness of 50-55). Consequently, Nesbitt's teaching would be understood to teach that the outer cover of the Nesbitt ball should have a similar Shore D hardness.</p>

Claim 3	Nesbitt and Molitor '637
A multi-layer golf ball comprising:	"The disclosure embraces a <b>golf ball</b> and method of making same ...." (Nesbitt, Abstract; FIGS 1 & 2.)
a spherical core;	"Referring to the drawings in detail there is illustrated a golf ball 10 which comprises a <b>solid center or core</b> formed as a solid body of resilient polymeric material or rubber-like material in the shape of a sphere." (Nesbitt, col. 2, lines 31-34.)
an inner cover layer having Shore D hardness of at least 60 disposed on said spherical core,	<p><b>Nesbitt:</b> "[I]nner cover 14 of molded <b>hard</b>, high flexural modulus resinous material such as <b>type 1605 Surlyn® marketed by E.I DuPont de Nemours.</b>" (Nesbitt, col. 2, lines 36-38.)</p> <p><b>Per the '293 Patent:</b> "Type 1605 Surlyn® (now designated Surlyn® 8940)." ('293 patent, col. 2, lines 54-55.)</p>

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Claim 3	Nesbitt and Molitor '637
	<p><b><u>DuPont Surlyn® Product Information:</u></b> Surlyn® 8940 (formerly Surlyn® 1605) has an “off the ball” Shore D hardness of 66. ('293 patent, Table 1.)</p> <p><b><u>Nesbitt Incorporates the Materials of Molitor '637 by Reference:</u></b> “Reference is made to the application Ser. No. 155,658 of Robert P. Molitor issued into U.S. Pat. No. 4,274,637 which describes a number of foamable compositions of a character which may be employed for ... layers 14 ... for the golf ball of this invention.” (Nesbitt, col. 3, lines 54-60.)</p> <p><b><u>Molitor '637:</u></b> Molitor '637 discloses a blend of two ionomers: Surlyn 1605 and Surlyn 1557. (Molitor '637, Table 1).</p> <p>Type 1557 Surlyn is now designated Surlyn 9650. (Ex. 25, DUP000038.) Surlyn 9650 has an “off the ball” Shore D hardness of 63. (Ex. 26, DUP000132.)</p> <p>The blend of Surlyn 8940 and 9650 has a Shore D hardness of 64.3 when measured off the ball. (See Ex. 29, “Blend 3”, AC 0131414.)</p> <p>Measurements of Surlyns made “on the ball” are higher than “on the ball” plaque measurements and would thus also be above 60. Ex. 19, Nesbitt Depo. Tr. at 244:12—244:17.</p>
said inner cover layer comprising an ionomeric resin including no more than 16% by weight of an alpha, beta-unsaturated carboxylic acid	<p><b><u>Nesbitt:</u></b> “[I]nner cover 14 of molded <b>hard</b>, high flexural modulus resinous material such as <b>type 1605 Surlyn® marketed by E.I DuPont de Nemours.</b>” (Nesbitt, col. 2, lines 36-38.)</p> <p>Type 1605 Surlyn® is now designated Surlyn® 8940. ('293 patent, col. 2, lines 54-55.) It has about 15% acid. ('293 patent, col. 2, lines 55-57.)</p> <p><b><u>Nesbitt Incorporates the Materials of Molitor '637 by Reference:</u></b> “Reference is made to the application Ser. No. 155,658 of Robert P. Molitor issued into U.S. Pat. No. 4,274,637 which describes a number of foamable compositions of a character which may be employed for ... layers 14 ... for the golf ball of this invention.” (Nesbitt, col. 3, lines 54-60.)</p> <p><b><u>Molitor '637:</u></b> Molitor teaches, in examples 1-7, cover materials</p>

## Invalidity Charts for U.S. Patent No. 6,595,873

Claim 3	Nesbitt and Molitor '637
	<p>including a blend of two ionomer resins: Surlyn 1605 and Surlyn 1557. (Molitor '637, col. 14, line 22 to col. 16, line 34.)</p> <p>Type 1557 Surlyn is now designated Surlyn 9650. (Ex. 25, DUP 000038.) It has an acid content of about 11%. (Ex. 26, DUP 000132.)</p> <p>Callaway admits that Nesbitt teaches the use of the ionomer blend found in Molitor '637 in a multi-layer golf ball. (See Ex. 24, Response to Office Action Mailed February 27, 2007 in Reexam. Cont. No. 95/000,120 at 16.)</p>
and having a modulus of from about 15,000 to about 70,000 psi; and	<p>Surlyn® 1605 inherently exhibits the claimed modulus.</p> <p>"Type 1605 Surlyn (Surlyn 8940) is a sodium ion based low acid (less than or equal to 15 weight percent methacrylic acid) ionomer resin having a flexural modulus of about 51,000 psi." ('293 patent, col. 2, lines 55-59.)</p>
an outer cover layer having a Shore D hardness of about 64 or less disposed about said inner cover layer and defining a plurality of dimples to form a multi-layer golf ball,	<p>"An outer layer, ply, lamination or cover 16 ... is then remolded onto the inner ply or layer 14...." (Nesbitt, col. 2, lines 43-47.)</p> <p><b><u>Nesbitt Incorporates the Materials of Molitor '637 by Reference:</u></b> "Reference is made to the application Ser. No. 155,658 of Robert P. Molitor issued into U.S. Pat. No. 4,274,637 which describes a number of foamable compositions of a character which may be employed for ... layers ... 16 for the golf ball of this invention." (Nesbitt, col. 3, lines 54-60.)</p> <p><b><u>Molitor '637:</u></b> Teaches the use of Estane 58133 in Examples 16 and 17. (Molitor '637, col. 18.) Estane is a soft polyurethane material that has a Shore D hardness of 55 as measured "off the ball." (CW 00615792.)</p> <p>When measured on the ball of Nesbitt (using Molitor '637's blend of ionomer as the inner cover layer), Molitor '637's outer cover layer has a Shore D hardness of 61.0. (Ex. 31, MacKnight Decl. at ¶ 33.) When measured on the ball of Nesbitt (using Nesbitt's Surlyn 1605 as the inner cover layer), Molitor '637's outer cover layer has a Shore D hardness of 62.0. (<i>Id.</i>)</p> <p><b><u>Nesbitt:</u></b> Once the materials for the cover layers are selected, Nesbitt teaches the that each cover layer may be more or less foamed to achieve the desired "soft over hard" quality of the golf ball: "The inner, intermediate or first layer 14 on the core 12 may</p>

## Invalidity Charts for U.S. Patent No. 6,595,873

Claim 3	Nesbitt and Molitor '637
	<p>be preferably partially or only slightly foamed to a low degree so as not to materially affect the coefficient of restitution of the material. The outer or cover layer or second layer 16 may be foamed to a greater degree than the inner, intermediate or first layer 14 as the material of the layer 16 is comparatively soft." Nesbitt, col. 3:62-68. Nesbitt teaches that the outer cover, in particular, should have the same hardness as balata: "The soft Surlyn resin cover would have about the same thickness and shore hardness of a balata covered golf ball...." Nesbitt, col. 3:40-42. Balata covered golf balls have an "on the ball" Shore D hardness from the high 40s to the low 50s. <i>See</i> Ex. 15 AC0049407 (1990 Competitive Ball Report) ("all high performance products have a similar construction; balata cover ranging from 47-54 Shore D hardness"); AC0049409 (showing Titleist Tour 100 having transpolyisoprene (synthetic balata) cover with a Shore D hardness of 54); AC0049411-12 (showing Titleist 384 Tour 100 with balata cover with Shore D hardness of 53); AC0049415-416 (showing Titleist 384 LT 100 with balata cover with Shore D hardness of 47); Ex. 16 at CW00522703 (Spalding Memo Showing same); <i>see also</i> Ex. 17, 1991 Competitive Ball Report at AC0049683-84 (showing on the ball hardness measurements for numerous balata balls ranging from 48-54 Shore D); Ex. 18 (1994 Competitive Ball Report) at AC0072912, AC0072915, AC0072916, and AC0072945 (showing numerous additional balata balls with on the ball Shore D hardness values ranging from 50-52. Ex. 19, Nesbitt Depo. Tr. at 121:19-122:5 (testifying that Titleist balata-covered golf balls had an on the ball Shore D hardness of 50-55). Consequently, Nesbitt's teaching would be understood to teach that the outer cover of the Nesbitt ball should have a similar Shore D hardness.</p> <p>"[T]he outer layer or cover 16 being of dimpled configuration...." (Nesbitt, col. 2, lines 48-49; Fig. 2.)</p>
<p>said outer cover layer comprising a polyurethane based material and</p>	<p><b><u>Nesbitt Incorporates Materials of Molitor by Reference:</u></b></p> <p>"Reference is made to the application Ser. No. 155,658, of Robert P. Molitor issued into U.S. Pat. No. 4,274,637 which describes a number of foamable compositions of a character which may be employed for one or both layers 14 and 16." (Nesbitt, col. 3, lines 54-60.)</p> <p><b><u>Molitor '637:</u></b> Teaches cover materials including "polyurethanes such as are prepared from polyols and organic polyisocyanates"; specifically teaches Estane 58133 thermoplastic polyurethane. (Molitor '637, col. 5, lines 39-41; col. 18, lines 31-59 (examples 16 and 17).)</p>

## Invalidity Charts for U.S. Patent No. 6,595,873

Claim 3	Nesbitt and Molitor '637
said outer cover layer having a thickness of from about 0.010 to about 0.070 inches.	<p data-bbox="630 300 1385 426">“The <b>thickness of the outer layer or cover 16</b> of soft, low flexural modulus resin such as Surlyn type 1855, <b>may be in the range of 0.020 inches and 0.100 inches.</b>” (Nesbitt, col. 3, lines 22-25.)</p> <p data-bbox="630 447 1349 512">“The <b>outer layer</b> of the soft resin is of a <b>thickness of 0.0575 inches.</b>” (Nesbitt, col. 3, lines 39-40.)</p>

# **EXHIBIT 33**

## Invalidity Charts for U.S. Patent No. 6,506,130

## Nesbitt Incorporating Molitor '637

Claim 5	Nesbitt
A multi-layer golf ball comprising:	"The disclosure embraces a <b>golf ball</b> and method of making same ...." (Nesbitt, Abstract; FIGS 1 & 2.)
a spherical core;	"Referring to the drawings in detail there is illustrated a golf ball 10 which comprises a <b>solid center or core</b> formed as a solid body of resilient polymeric material or rubber-like material <b>in the shape of a sphere.</b> " (Nesbitt, col. 2, lines 31-34.)
an inner cover layer having ...	"Disposed on the spherical center or core 12 is a first layer, lamination, ply or <b>inner cover 14</b> of molded hard, highly flexural modulus resinous material...." (Nesbitt, col. 2, lines 34-37.)
a Shore D hardness of 60 or more molded over said spherical core	<p><b>Nesbitt:</b> "[I]nner cover 14 of molded <b>hard</b>, high flexural modulus resinous material such as <b>type 1605 Surlyn® marketed by E.I DuPont de Nemours.</b>" (Nesbitt, col. 2, lines 36-38.)</p> <p><b>Per the '293 Patent:</b> "Type 1605 Surlyn® (now designated Surlyn® 8940)." ('293 patent, col. 2, lines 54-55.)</p> <p><b>DuPont Surlyn® Product Information:</b> Surlyn® 8940 (formerly Surlyn® 1605) has an "off the ball" Shore D hardness of 66. ('293 patent, Table 1.)</p> <p><b>Nesbitt Incorporates the Materials of Molitor '637 by Reference:</b> "Reference is made to the application Ser. No. 155,658 of <b>Robert P. Molitor issued into U.S. Pat. No. 4,274,637</b> which describes a number of foamable compositions of a character which may be employed for ... layers 14 ... for the golf ball of this invention." (Nesbitt, col. 3, lines 54-60.)</p> <p><b>Molitor '637:</b> Molitor '637 discloses a blend of two ionomers: Surlyn 1605 and Surlyn 1557. (Molitor '637, Table 1).</p> <p>Type 1557 Surlyn is now designated Surlyn 9650. (Ex. 25, DUP000038.) Surlyn 9650 has an "off the ball" Shore D hardness of 63. (Ex. 26, DUP000132.)</p> <p>The blend of Surlyn 8940 and 9650 has a Shore D hardness of 64.3 when measured off the ball. (See Ex. 29, "Blend 3", AC 0131414.)</p> <p>Measurements of Surlins made "on the ball" are higher than "on</p>

## Invalidity Charts for U.S. Patent No. 6,506,130

Claim 5	Nesbitt
	the ball" plaque measurements and would thus also be above 60. Ex. 19, Nesbitt Depo. Tr. at 244:12—244:17.
said inner cover layer comprising an ionomeric resin comprising no more than 16% by weight of an alpha, beta-unsaturated carboxylic acid	<p><b>Nesbitt:</b> "[I]nner cover 14 of molded <b>hard</b>, high flexural modulus resinous material such as <b>type 1605 Surlyn® marketed by E.I DuPont de Nemours.</b>" (Nesbitt, col. 2, lines 36-38.)</p> <p>Type 1605 Surlyn® is now designated Surlyn® 8940. ('293 patent, col. 2, lines 54-55.) It has about 15% acid. ('293 patent, col. 2, lines 55-57.)</p> <p><b>Nesbitt Incorporates the Materials of Molitor '637 by Reference:</b> "Reference is made to the application Ser. No. 155,658 of <b>Robert P. Molitor issued into U.S. Pat. No. 4,274,637</b> which describes a number of foamable compositions of a character which may be employed for ... layers 14 ... for the golf ball of this invention." (Nesbitt, col. 3, lines 54-60.)</p> <p><b>Molitor '637:</b> Molitor teaches, in examples 1-7, cover materials including a blend of two ionomer resins: Surlyn 1605 and Surlyn 1557. (Molitor '637, col. 14, line 22 to col. 16, line 34.)</p> <p>Type 1557 Surlyn is now designated Surlyn 9650. (Ex. 25, DUP 000038.) It has an acid content of about 11%. (Ex. 26, DUP 000132.)</p> <p>Callaway admits that Nesbitt teaches the use of the ionomer blend found in Molitor '637 in a multi-layer golf ball. (See Ex. 24, Response to Office Action Mailed February 27, 2007 in Reexam. Cont. No. 95/000,120 at 16.)</p>
and having a modulus of from about 15,000 to about 70,000 psi;	<p>Surlyn® 1605 inherently exhibits the claimed modulus.</p> <p><b>"Type 1605 Surlyn (Surlyn 8940)</b> is a sodium ion based low acid (less than or equal to 15 weight percent methacrylic acid) ionomer resin having a <b>flexural modulus of about 51,000 psi.</b>" ('293 patent, col. 2, lines 55-59.)</p>
an outer cover layer having ...	"An outer layer, ply, lamination or cover 16 ... is then remolded onto the inner play or layer 14...." (Nesbitt, col. 2, lines 43-47.)
a Shore D hardness of 64 or less	<p><b>Nesbitt Incorporates the Materials of Molitor '637 by Reference:</b> "Reference is made to the application Ser. No. 155,658 of <b>Robert P. Molitor issued into U.S. Pat. No. 4,274,637</b> which describes a number of foamable compositions of a character which may be employed for ... layers ... 16 for the</p>

## Invalidity Charts for U.S. Patent No. 6,506,130

Claim 5	Nesbitt
	<p data-bbox="683 302 1354 333">golf ball of this invention.” (Nesbitt, col. 3, lines 54-60.)</p> <p data-bbox="683 386 1451 520"><b><u>Molitor '637</u></b>: Teaches the use of <b>Estane 58133</b> in Examples 16 and 17. (Molitor '637, col. 18.) Estane is a soft polyurethane material that has a <b>Shore D hardness of 55 as measured “off the ball.”</b> (CW 00615792.)</p> <p data-bbox="683 573 1451 772">When measured <b>on the ball of Nesbitt</b> (using Molitor '637's blend of ionomer as the inner cover layer), Molitor '637's outer cover layer has a Shore D hardness of 61.0. (Ex. 31, MacKnight Decl. at ¶ 33.) When measured on the ball of Nesbitt (using Nesbitt's Surlyn 1605 as the inner cover layer), Molitor '637's outer cover layer has a Shore D hardness of 62.0. (<i>Id.</i>)</p> <p data-bbox="683 825 1451 1833"><b><u>Nesbitt</u></b>: Once the materials for the cover layers are selected, Nesbitt teaches the that each cover layer may be more or less foamed to achieve the desired “soft over hard” quality of the golf ball: “The inner, intermediate or first layer 14 on the core 12 may be preferably partially or only slightly foamed to a low degree so as not to materially affect the coefficient of restitution of the material. The outer or cover layer or second layer 16 may be foamed to a greater degree than the inner, intermediate or first layer 14 as the material of the layer 16 is comparatively soft.” Nesbitt, col. 3:62-68. Nesbitt teaches that the outer cover, in particular, should have the same hardness as balata: “The soft Surlyn resin cover would have about the same thickness and shore hardness of a balata covered golf ball....” Nesbitt, col. 3:40-42. Balata covered golf balls have an “on the ball” Shore D hardness from the high 40s to the low 50s. <i>See</i> Ex. 15 AC0049407 (1990 Competitive Ball Report) (“all high performance products have a similar construction; balata cover ranging from 47-54 Shore D hardness”); AC0049409 (showing Titleist Tour 100 having transpolyisoprene (synthetic balata) cover with a Shore D hardness of 54); AC0049411-12 (showing Titleist 384 Tour 100 with balata cover with Shore D hardness of 53); AC0049415-416 (showing Titleist 384 LT 100 with balata cover with Shore D hardness of 47); Ex. 16 at CW00522703 (Spalding Memo Showing same); <i>see also</i> Ex. 17, 1991 Competitive Ball Report at AC0049683-84 (showing on the ball hardness measurements for numerous balata balls ranging from 48-54 Shore D); Ex. 18 (1994 Competitive Ball Report) at AC0072912, AC0072915, AC0072916, and AC0072945 (showing numerous additional balata balls with on the ball Shore D hardness values ranging from 50-52. Ex. 19, Nesbitt Depo. Tr.</p>

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Claim 5	Nesbitt
	at 121:19-122:5 (testifying that Titleist balata-covered golf balls had an on the ball Shore D hardness of 50-55). Consequently, Nesbitt's teaching would be understood to teach that the outer cover of the Nesbitt ball should have a similar Shore D hardness.
molded over said spherical intermediate ball to form a multi-layer golf ball	"An outer layer, ply, lamination or cover 16 of comparatively soft, low flexural modulus resinous material ... is then <b>re-molded onto the inner ply or layer 14 ....</b> " (Nesbitt, col. 2, lines 43-47.)
the outer cover layer comprising a polyurethane based material.	<p><b><u>Nesbitt Incorporates Materials of Molitor by Reference:</u></b>  "Reference is made to the application Ser. No. 155,658, of Robert P. Molitor issued into U.S. Pat. No. 4,274,637 which describes a number of foamable compositions of a character which may be employed for one or both layers 14 and 16." (Nesbitt, col. 3, lines 54-60.)</p> <p><b><u>Molitor '637:</u></b> Teaches cover materials including "polyurethanes such as are prepared from polyols and organic polyisocyanates"; specifically teaches Estane 58133 thermoplastic polyurethane. (Molitor '637, col. 5, lines 39-41; col. 18, lines 31-59 (examples 16 and 17).)</p>

# **EXHIBIT 34**

## Invalidity Charts for U.S. Patent No. 6,503,156

## NESBITT INCORPORATING MOLITOR '637

Claim 1	Nesbitt and Molitor '637
A golf ball comprising:	"The disclosure embraces a <b>golf ball</b> and method of making same ...." (Nesbitt, Abstract; FIGS 1 & 2.)
a core;	"Referring to the drawings in detail there is illustrated a golf ball 10 which comprises a <b>solid center or core</b> formed as a solid body of resilient polymeric material or rubber-like material in the shape of a sphere." (Nesbitt, col. 2, lines 31-34.)
an inner cover layer having disposed on said core, ...	"Disposed on the spherical center or core 12 is a first layer, lamination, ply or <b>inner cover 14</b> of molded hard, highly flexural modulus resinous material...." (Nesbitt, col. 2, lines 34-37.)
said inner cover layer having a Shore D hardness of at least 60,	<p><b>Nesbitt:</b> "[I]nner cover 14 of molded <b>hard</b>, high flexural modulus resinous material such as <b>type 1605 Surlyn® marketed by E.I DuPont de Nemours.</b>" (Nesbitt, col. 2, lines 36-38.)</p> <p><b>Per the '293 Patent:</b> "Type 1605 Surlyn® (now designated Surlyn® 8940)." ('293 patent, col. 2, lines 54-55.)</p> <p><b>DuPont Surlyn® Product Information:</b> Surlyn® 8940 (formerly Surlyn® 1605) has an "off the ball" Shore D hardness of 66. ('293 patent, Table 1.)</p> <p><b>Nesbitt Incorporates the Materials of Molitor '637 by Reference:</b> "Reference is made to the application Ser. No. 155,658 of <b>Robert P. Molitor issued into U.S. Pat. No. 4,274,637</b> which describes a number of foamable compositions of a character which may be employed for ... layers 14 ... for the golf ball of this invention." (Nesbitt, col. 3, lines 54-60.)</p> <p><b>Molitor '637:</b> Molitor '637 discloses a blend of two ionomers: Surlyn 1605 and Surlyn 1557. (Molitor '637, Table 1).</p> <p>Type 1557 Surlyn is now designated Surlyn 9650. (Ex. 25, DUP000038.) Surlyn 9650 has an "off the ball" Shore D hardness of 63. (Ex. 26, DUP000132.)</p> <p>The blend of Surlyn 8940 and 9650 has a Shore D hardness of 64.3 when measured off the ball. (See Ex. 29, "Blend 3", AC 0131414.)</p> <p>Measurements of Surlyns made "on the ball" are higher than "on the ball" plaque measurements and would thus also be above 60. Ex. 19, Nesbitt Depo. Tr. at 244:12—244:17.</p>

## Invalidity Charts for U.S. Patent No. 6,503,156

Claim 1	Nesbitt and Molitor '637
<p>said inner cover layer comprising a blend of two or more low acid ionomer resins, each containing no more than 16% by weight of an alpha, beta-unsaturated carboxylic acid; and,</p>	<p><b><u>Nesbitt Incorporates the Materials of Molitor '637 by Reference:</u></b> "Reference is made to the application Ser. No. 155,658 of <b>Robert P. Molitor issued into U.S. Pat. No. 4,274,637</b> which describes a number of foamable compositions of a character which may be employed for ... layers 14 ... for the golf ball of this invention." (Nesbitt, col. 3, lines 54-60.)</p> <p><b><u>Molitor '637:</u></b> Molitor teaches, in examples 1-7, cover materials including a blend of two ionomer resins: Surlyn 1605 and Surlyn 1557. (Molitor '637, col. 14, line 22 to col. 16, line 34.)</p> <p>Type 1605 Surlyn® is now designated Surlyn® 8940. ('293 patent, col. 2, lines 54-55.) It has about 15% acid. ('293 patent, col. 2, lines 55-57.)</p> <p>Type 1557 Surlyn is now designated Surlyn 9650. (Ex. 25, DUP 000038.) It has an acid content of about 11%. (Ex. 26, DUP 000132.)</p> <p>Callaway admits that Nesbitt teaches the use of the ionomer blend found in Molitor '637 in a multi-layer golf ball. (See Ex. 24, Response to Office Action Mailed February 27, 2007 in Reexam. Cont. No. 95/000,120 at 16.)</p>
<p>an outer cover layer disposed on said inner cover layer,</p>	<p>"An outer layer, ply, lamination or cover 16 ... is then remolded onto the inner ply or layer 14...." (Nesbitt, col. 2, lines 43-47.)</p>
<p>said outer cover layer having a Shore D hardness of about 64 or less,</p>	<p><b><u>Nesbitt Incorporates the Materials of Molitor '637 by Reference:</u></b> "Reference is made to the application Ser. No. 155,658 of <b>Robert P. Molitor issued into U.S. Pat. No. 4,274,637</b> which describes a number of foamable compositions of a character which may be employed for ... layers ... 16 for the golf ball of this invention." (Nesbitt, col. 3, lines 54-60.)</p> <p><b><u>Molitor '637:</u></b> Teaches the use of <b>Estane 58133</b> in Examples 16 and 17. (Molitor '637, col. 18.) Estane is a soft polyurethane material that has a <b>Shore D hardness of 55 as measured "off the ball."</b> (CW 00615792.)</p> <p>When measured <b>on the ball of Nesbitt</b> (using Molitor '637's blend of ionomer as the inner cover layer), Molitor '637's outer cover layer has a Shore D hardness of 61.0. (Ex. 31, MacKnight</p>

## Invalidity Charts for U.S. Patent No. 6,503,156

Claim 1	Nesbitt and Molitor '637
	<p>Decl. at ¶ 33.) When measured on the ball of Nesbitt (using Nesbitt's Surlyn 1605 as the inner cover layer), Molitor '637's outer cover layer has a Shore D hardness of 62.0. (<i>Id.</i>)</p> <p><b>Nesbitt:</b> Once the materials for the cover layers are selected, Nesbitt teaches the that each cover layer may be more or less foamed to achieve the desired "soft over hard" quality of the golf ball: "The inner, intermediate or first layer 14 on the core 12 may be preferably partially or only slightly foamed to a low degree so as not to materially affect the coefficient of restitution of the material. The outer or cover layer or second layer 16 may be foamed to a greater degree than the inner, intermediate or first layer 14 as the material of the layer 16 is comparatively soft." Nesbitt, col. 3:62-68. Nesbitt teaches that the outer cover, in particular, should have the same hardness as balata: "The soft Surlyn resin cover would have about the same thickness and shore hardness of a balata covered golf ball...." Nesbitt, col. 3:40-42. Balata covered golf balls have an "on the ball" Shore D hardness from the high 40s to the low 50s. <i>See</i> Ex. 15 AC0049407 (1990 Competitive Ball Report) ("all high performance products have a similar construction; balata cover ranging from 47-54 Shore D hardness"); AC0049409 (showing Titleist Tour 100 having transpolyisoprene (synthetic balata) cover with a Shore D hardness of 54); AC0049411-12 (showing Titleist 384 Tour 100 with balata cover with Shore D hardness of 53); AC0049415-416 (showing Titleist 384 LT 100 with balata cover with Shore D hardness of 47); Ex. 16 at CW00522703 (Spalding Memo Showing same); <i>see also</i> Ex. 17, 1991 Competitive Ball Report at AC0049683-84 (showing on the ball hardness measurements for numerous balata balls ranging from 48-54 Shore D); Ex. 18 (1994 Competitive Ball Report) at AC0072912, AC0072915, AC0072916, and AC0072945 (showing numerous additional balata balls with on the ball Shore D hardness values ranging from 50-52. Ex. 19, Nesbitt Depo. Tr. at 121:19-122:5 (testifying that Titleist balata-covered golf balls had an on the ball Shore D hardness of 50-55). Consequently, Nesbitt's teaching would be understood to teach that the outer cover of the Nesbitt ball should have a similar Shore D hardness.</p>
a thickness of from about 0.01 to about 0.07 inches,	<p>"It is found that the inner layer of hard, high flexural modulus resinous material such as Surlyn® resin type 1605, is preferably of a thickness in a range of 0.020 inches and 0.070 inches." (Nesbitt, col. 3, lines 19-23.)</p> <p>"The outer layer of the soft resin is of a thickness of 0.0575</p>

## Invalidity Charts for U.S. Patent No. 6,503,156

Claim 1	Nesbitt and Molitor '637
	inches." (Nesbitt, col. 3, lines 39-40.)
and comprising a polyurethane material.	<p><b><u>Nesbitt Incorporates Materials of Molitor by Reference:</u></b>  "Reference is made to the application Ser. No. 155,658, of Robert P. Molitor issued into U.S. Pat. No. 4,274,637 which describes a number of foamable compositions of a character which may be employed for one or both layers 14 and 16." (Nesbitt, col. 3, lines 54-60.)</p> <p><b><u>Molitor '637:</u></b> Teaches cover materials including "polyurethanes such as are prepared from polyols and organic polyisocyanates"; specifically teaches Estane 58133 thermoplastic polyurethane. (Molitor '637, col. 5, lines 39-41; col. 18, lines 31-59 (examples 16 and 17).)</p>

Claim 2	Nesbitt and Molitor '637
The golf ball of claim 1	See above.
wherein said outer cover layer has a thickness of from about 0.01 to about 0.05 inches.	"The <b>thickness of the outer layer or cover 16</b> of soft, low flexural modulus resin such as Surlyn type 1855, <b>may be in the range of 0.020 inches and 0.100 inches.</b> " (Nesbitt, col. 3, lines 22-25.)

Claim 3	Nesbitt and Molitor '637
The golf ball of claim 1	See above.
wherein said outer cover layer has a thickness of from about 0.03 to about 0.06 inches.	<p>"The <b>thickness of the outer layer or cover 16</b> of soft, low flexural modulus resin such as Surlyn type 1855, <b>may be in the range of 0.020 inches and 0.100 inches.</b>" (Nesbitt, col. 3, lines 22-25.)</p> <p>"The <b>outer layer of the soft resin is of a thickness of 0.0575 inches.</b>" (Nesbitt, col. 3, lines 39-40.)</p>

# **EXHIBIT 35**

## Invalidity Charts for U.S. Patent No. 6,210,293

## NESBITT INCORPORATING MOLITOR '637

Claim 1	Nesbitt and Molitor '637
A golf ball comprising:	"The disclosure embraces a <b>golf ball</b> and method of making same ...." (Nesbitt (Ex. 10), Abstract; FIGS 1 & 2.)
a core;	"Referring to the drawings in detail there is illustrated a golf ball 10 which comprises a <b>solid center or core</b> formed as a solid body of resilient polymeric material or rubber-like material in the shape of a sphere." (Nesbitt (Ex. 10), col. 2, lines 31-34.)
an inner cover layer having ...	"Disposed on the spherical center or core 12 is a first layer, lamination, ply or <b>inner cover 14</b> of molded hard, highly flexural modulus resinous material...." (Nesbitt (Ex. 10), col. 2, lines 34-37.)
a Shore D hardness of 60 or more molded on said core,	<p><b>Nesbitt:</b> "[I]nner cover 14 of molded <b>hard</b>, high flexural modulus resinous material such as <b>type 1605 Surlyn® marketed by E.I DuPont de Nemours.</b>" (Nesbitt, col. 2, lines 36-38.)</p> <p><b>Per the '293 Patent:</b> "Type 1605 Surlyn® (now designated Surlyn® 8940)." ('293 patent, col. 2, lines 54-55.)</p> <p><b>DuPont Surlyn® Product Information:</b> Surlyn® 8940 (formerly Surlyn® 1605) has an "off the ball" Shore D hardness of 66. ('293 patent, Table 1.)</p> <p><b>Nesbitt Incorporates the Materials of Molitor '637 by Reference:</b> "Reference is made to the application Ser. No. 155,658 of <b>Robert P. Molitor</b> issued into <b>U.S. Pat. No. 4,274,637</b> which describes a number of foamable compositions of a character which may be employed for ... layers 14 ... for the golf ball of this invention." (Nesbitt, col. 3, lines 54-60.)</p> <p><b>Molitor '637:</b> Molitor '637 discloses a blend of two ionomers: Surlyn 1605 and Surlyn 1557. (Molitor '637, Table 1).</p> <p>Type 1557 Surlyn is now designated Surlyn 9650. (Ex. 25, DUP000038.) Surlyn 9650 has an "off the ball" Shore D hardness of 63. (Ex. 26, DUP000132.)</p> <p>The blend of Surlyn 8940 and 9650 has a Shore D hardness of 64.3 when measured off the ball. (See Ex. 29, "Blend 3", AC 0131414.)</p> <p>Measurements of Surlyns made "on the ball" are higher than "on the ball" plaque measurements and would thus also be above 60.</p>

## Invalidity Charts for U.S. Patent No. 6,210,293

Claim 1	Nesbitt and Molitor '637
	Ex. 19, Nesbitt Depo. Tr. at 244:12—244:17.
said inner cover layer having a thickness of 0.100 to 0.010 inches,	“It is found that the inner layer of hard, high flexural modulus resinous material such as Surlyn® resin type 1605, is preferably of a thickness in a range of 0.020 inches and 0.070 inches.” (Nesbitt, col. 3, lines 19-23.)
said inner cover layer comprising a blend of two or more low acid ionomer resins containing no more than 16% by weight of an alpha, beta-unsaturated carboxylic acid; and	<p><b><u>Nesbitt Incorporates the Materials of Molitor '637 by Reference:</u></b> “Reference is made to the application Ser. No. 155,658 of <b>Robert P. Molitor</b> issued into U.S. Pat. No. <b>4,274,637</b> which describes a number of foamable compositions of a character which may be employed for ... layers 14 ... for the golf ball of this invention.” (Nesbitt, col. 3, lines 54-60.)</p> <p><b><u>Molitor '637:</u></b> Molitor teaches, in examples 1-7, cover materials including a blend of two ionomer resins: Surlyn 1605 and Surlyn 1557. (Molitor '637, col. 14, line 22 to col. 16, line 34.)</p> <p>Type 1605 Surlyn® is now designated Surlyn® 8940. ('293 patent, col. 2, lines 54-55.) It has about 15% acid. ('293 patent, col. 2, lines 55-57.)</p> <p>Type 1557 Surlyn is now designated Surlyn 9650. (Ex. 25, DUP 000038.) It has an acid content of about 11%. (Ex. 26, DUP 000132.)</p> <p>Callaway admits that Nesbitt teaches the use of the ionomer blend found in Molitor '637 in a multi-layer golf ball. (See Ex. 24, Response to Office Action Mailed February 27, 2007 in Reexam. Cont. No. 95/000,120 at 16.)</p>
an outer cover layer having ...	“An outer layer, ply, lamination or cover 16 ... is then remolded onto the inner ply or layer 14....” (Nesbitt, col. 2, lines 43-47.)
a Shore D hardness of 64 or less molded on said inner cover layer,	<p><b><u>Nesbitt Incorporates the Materials of Molitor '637 by Reference:</u></b> “Reference is made to the application Ser. No. 155,658 of <b>Robert P. Molitor</b> issued into U.S. Pat. No. <b>4,274,637</b> which describes a number of foamable compositions of a character which may be employed for ... layers ... 16 for the golf ball of this invention.” (Nesbitt, col. 3, lines 54-60.)</p> <p><b><u>Molitor '637:</u></b> Teaches the use of <b>Estane 58133</b> in Examples 16 and 17. (Molitor '637, col. 18.) Estane is a soft polyurethane material that has a <b>Shore D hardness of 55 as measured “off</b></p>

## Invalidity Charts for U.S. Patent No. 6,210,293

Claim 1	Nesbitt and Molitor '637 the ball." (CW 00615792.)
	<p>When measured <b>on the ball of Nesbitt</b> (using Molitor '637's blend of ionomer as the inner cover layer), Molitor '637's outer cover layer has a Shore D hardness of 61.0. (Ex. 31, MacKnight Decl. at ¶ 33.) When measured on the ball of Nesbitt (using Nesbitt's Surlyn 1605 as the inner cover layer), Molitor '637's outer cover layer has a Shore D hardness of 62.0. (<i>Id.</i>)</p> <p><b>Nesbitt:</b> Once the materials for the cover layers are selected, Nesbitt teaches the that each cover layer may be more or less foamed to achieve the desired "soft over hard" quality of the golf ball: "The inner, intermediate or first layer 14 on the core 12 may be preferably partially or only slightly foamed to a low degree so as not to materially affect the coefficient of restitution of the material. The outer or cover layer or second layer 16 may be foamed to a greater degree than the inner, intermediate or first layer 14 as the material of the layer 16 is comparatively soft." Nesbitt, col. 3:62-68. Nesbitt teaches that the outer cover, in particular, should have the same hardness as balata: "The soft Surlyn resin cover would have about the same thickness and shore hardness of a balata covered golf ball...." Nesbitt, col. 3:40-42. Balata covered golf balls have an "on the ball" Shore D hardness from the high 40s to the low 50s. <i>See</i> Ex. 15 AC0049407 (1990 Competitive Ball Report) ("all high performance products have a similar construction; balata cover ranging from 47-54 Shore D hardness"); AC0049409 (showing Titleist Tour 100 having transpolyisoprene (synthetic balata) cover with a Shore D hardness of 54); AC0049411-12 (showing Titleist 384 Tour 100 with balata cover with Shore D hardness of 53); AC0049415-416 (showing Titleist 384 LT 100 with balata cover with Shore D hardness of 47); Ex. 16 at CW00522703 (Spalding Memo Showing same); <i>see also</i> Ex. 17, 1991 Competitive Ball Report at AC0049683-84 (showing on the ball hardness measurements for numerous balata balls ranging from 48-54 Shore D); Ex. 18 (1994 Competitive Ball Report) at AC0072912, AC0072915, AC0072916, and AC0072945 (showing numerous additional balata balls with on the ball Shore D hardness values ranging from 50-52. Ex. 19, Nesbitt Depo. Tr. at 121:19-122:5 (testifying that Titleist balata-covered golf balls had an on the ball Shore D hardness of 50-55). Consequently, Nesbitt's teaching would be understood to teach that the outer cover of the Nesbitt ball should have a similar Shore D hardness.</p>

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<b>Claim 1</b>	<b>Nesbitt and Molitor '637</b>
said outer cover layer having a thickness of 0.010 to 0.070 inches, and	<p>“The <b>thickness of the outer layer or cover 16</b> of soft, low flexural modulus resin such as Surlyn type 1855, <b>may be in the range of 0.020 inches and 0.100 inches.</b>” (Nesbitt, col. 3, lines 22-25.)</p> <p>“The outer layer of the soft resin is of a thickness of <b>0.0575 inches.</b>” (Nesbitt, col. 3, lines 39-40.)</p>
said outer cover layer comprising a relatively soft polyurethane material.	<p><b><u>Nesbitt Incorporates Materials of Molitor by Reference:</u></b>  “Reference is made to the application Ser. No. 155,658, of Robert P. Molitor issued into U.S. Pat. No. 4,274,637 which describes a number of foamable compositions of a character which may be employed for one or both layers 14 and 16.” (Nesbitt, col. 3, lines 54-60.)</p> <p><b><u>Molitor '637:</u></b> Teaches cover materials including “polyurethanes such as are prepared from polyols and organic polyisocyanates”; specifically teaches Estane 58133 thermoplastic polyurethane. (Molitor '637, col. 5, lines 39-41; col. 18, lines 31-59 (examples 16 and 17).) Estane 58133 is a relatively soft polyurethane material. (Molitor '637, col. 18.)</p>

## Invalidity Charts for U.S. Patent No. 6,210,293

Claim 4	Nesbitt and Molitor '637
A multi-layer golf-ball comprising:	"The disclosure embraces a <b>golf ball</b> and method of making same ...." (Nesbitt (Ex. 10), Abstract; FIGS 1 & 2.)
a spherical core;	"Referring to the drawings in detail there is illustrated a golf ball 10 which comprises a <b>solid center or core</b> formed as a solid body of resilient polymeric material or rubber-like material <b>in the shape of a sphere.</b> " (Nesbitt (Ex. 10), col. 2, lines 31-34.)
an inner cover layer having ...	"Disposed on the spherical center or core 12 is a first layer, lamination, ply or <b>inner cover 14</b> of molded hard, high flexural modulus resinous material...." (Nesbitt (Ex. 10), col. 2, lines 34-37.)

## Invalidity Charts for U.S. Patent No. 6,210,293

Claim 4	Nesbitt and Molitor '637
a Shore D hardness of 60 or more molded over said spherical core	<p><b><u>Nesbitt:</u></b> “[I]nner cover 14 of molded <b>hard</b>, high flexural modulus resinous material such as <b>type 1605 Surlyn® marketed by E.I DuPont de Nemours.</b>” (Nesbitt, col. 2, lines 36-38.)</p> <p><b><u>Per the '293 Patent:</u></b> “Type 1605 Surlyn® (now designated Surlyn® 8940).” ('293 patent, col. 2, lines 54-55.)</p> <p><b><u>DuPont Surlyn® Product Information:</u></b> Surlyn® 8940 (formerly Surlyn® 1605) has an “off the ball” Shore D hardness of 66. ('293 patent, Table 1.)</p> <p><b><u>Nesbitt Incorporates the Materials of Molitor '637 by Reference:</u></b> “Reference is made to the application Ser. No. 155,658 of <b>Robert P. Molitor issued into U.S. Pat. No. 4,274,637</b> which describes a number of foamable compositions of a character which may be employed for ... layers 14 ... for the golf ball of this invention.” (Nesbitt, col. 3, lines 54-60.)</p> <p><b><u>Molitor '637:</u></b> Molitor '637 discloses a blend of two ionomers: Surlyn 1605 and Surlyn 1557. (Molitor '637, Table 1).</p> <p>Type 1557 Surlyn is now designated Surlyn 9650. (Ex. 25, DUP000038.) Surlyn 9650 has an “off the ball” Shore D hardness of 63. (Ex. 26, DUP000132.)</p> <p>The blend of Surlyn 8940 and 9650 has a Shore D hardness of 64.3 when measured off the ball. (See Ex. 29, “Blend 3”, AC 0131414.)</p> <p>Measurements of Surlyns made “on the ball” are higher than “on the ball” plaque measurements and would thus also be above 60. Ex. 19, Nesbitt Depo. Tr. at 244:12—244:17.</p>

## Invalidity Charts for U.S. Patent No. 6,210,293

Claim 4	Nesbitt and Molitor '637
said inner cover layer comprising an ionomeric resin including no more than 16% by weight of alpha, beta-unsaturated carboxylic acid	<p><b>Nesbitt:</b> "[I]nner cover 14 of molded <b>hard</b>, high flexural modulus resinous material such as <b>type 1605 Surlyn® marketed by E.I DuPont de Nemours.</b>" (Nesbitt, col. 2, lines 36-38.)</p> <p>Type 1605 Surlyn® is now designated Surlyn® 8940. ('293 patent, col. 2, lines 54-55.) It has about 15% acid. ('293 patent, col. 2, lines 55-57.)</p> <p><b>Nesbitt Incorporates the Materials of Molitor '637 by Reference:</b> "Reference is made to the application Ser. No. 155,658 of <b>Robert P. Molitor issued into U.S. Pat. No. 4,274,637</b> which describes a number of foamable compositions of a character which may be employed for ... layers 14 ... for the golf ball of this invention." (Nesbitt, col. 3, lines 54-60.)</p> <p><b>Molitor '637:</b> Molitor teaches, in examples 1-7, cover materials including a blend of two ionomer resins: Surlyn 1605 and Surlyn 1557. (Molitor '637, col. 14, line 22 to col. 16, line 34.)</p> <p>Type 1557 Surlyn is now designated Surlyn 9650. (Ex. 25, DUP 000038.) It has an acid content of about 11%. (Ex. 26, DUP 000132.)</p> <p>Callaway admits that Nesbitt teaches the use of the ionomer blend found in Molitor '637 in a multi-layer golf ball. (See Ex. 24, Response to Office Action Mailed February 27, 2007 in Reexam. Cont. No. 95/000,120 at 16.)</p>
and having a modulus of from about 15,000 to about 70,000 psi	<p>Surlyn® 1605 inherently exhibits the claimed modulus.</p> <p><b>"Type 1605 Surlyn (Surlyn 8940) is a sodium ion based low acid (less than or equal to 15 weight percent methacrylic acid) ionomer resin having a flexural modulus of about 51,000 psi."</b> ('293 patent, col. 2, lines 55-59.)</p>
an outer cover layer having	<p>"An outer layer, ply, lamination or cover 16 ... is then remolded onto the inner ply or layer 14...." (Nesbitt, col. 2, lines 43-47.)</p>
a Shore D hardness of about 64 or less	<p><b>Nesbitt Incorporates the Materials of Molitor '637 by Reference:</b> "Reference is made to the application Ser. No. 155,658 of <b>Robert P. Molitor issued into U.S. Pat. No. 4,274,637</b> which describes a number of foamable compositions of a character which may be employed for ... layers ... 16 for</p>

## Invalidity Charts for U.S. Patent No. 6,210,293

Claim 4	Nesbitt and Molitor '637
	<p>the golf ball of this invention.” (Nesbitt, col. 3, lines 54-60.)</p> <p><b>Molitor '637:</b> Teaches the use of <b>Estane 58133</b> in Examples 16 and 17. (Molitor '637, col. 18.) Estane is a soft polyurethane material that has a <b>Shore D hardness of 55 as measured “off the ball.”</b> (CW 00615792.)</p> <p>When measured <b>on the ball of Nesbitt</b> (using Molitor '637's blend of ionomer as the inner cover layer), Molitor '637's outer cover layer has a Shore D hardness of 61.0. (Ex. 31, MacKnight Decl. at ¶ 33.) When measured on the ball of Nesbitt (using Nesbitt's Surlyn 1605 as the inner cover layer), Molitor '637's outer cover layer has a Shore D hardness of 62.0. (<i>Id.</i>)</p> <p><b>Nesbitt:</b> Once the materials for the cover layers are selected, Nesbitt teaches the that each cover layer may be more or less foamed to achieve the desired “soft over hard” quality of the golf ball: “The inner, intermediate or first layer 14 on the core 12 may be preferably partially or only slightly foamed to a low degree so as not to materially affect the coefficient of restitution of the material. The outer or cover layer or second layer 16 may be foamed to a greater degree than the inner, intermediate or first layer 14 as the material of the layer 16 is comparatively soft.” Nesbitt, col. 3:62-68. Nesbitt teaches that the outer cover, in particular, should have the same hardness as balata: “The soft Surlyn resin cover would have about the same thickness and shore hardness of a balata covered golf ball....” Nesbitt, col. 3:40-42. Balata covered golf balls have an “on the ball” Shore D hardness from the high 40s to the low 50s. <i>See</i> Ex. 15 AC0049407 (1990 Competitive Ball Report) (“all high performance products have a similar construction; balata cover ranging from 47-54 Shore D hardness”); AC0049409 (showing Titleist Tour 100 having transpolyisoprene (synthetic balata) cover with a Shore D hardness of 54); AC0049411-12 (showing Titleist 384 Tour 100 with balata cover with Shore D hardness of 53); AC0049415-416 (showing Titleist 384 LT 100 with balata cover with Shore D hardness of 47); Ex. 16 at CW00522703 (Spalding Memo Showing same); <i>see also</i> Ex. 17, 1991 Competitive Ball Report at AC0049683-84 (showing on the ball hardness measurements for numerous balata balls ranging from 48-54 Shore D); Ex. 18 (1994 Competitive Ball Report) at AC0072912, AC0072915, AC0072916, and AC0072945 (showing numerous additional balata balls with on</p>

## Invalidity Charts for U.S. Patent No. 6,210,293

Claim 4	Nesbitt and Molitor '637
	the ball Shore D hardness values ranging from 50-52. Ex. 19, Nesbitt Depo. Tr. at 121:19-122:5 (testifying that Titleist balata-covered golf balls had an on the ball Shore D hardness of 50-55). Consequently, Nesbitt's teaching would be understood to teach that the outer cover of the Nesbitt ball should have a similar Shore D hardness.
disposed about said inner cover layer and defining a plurality of dimples to form a multi-layer golf ball	<p>"An outer layer, ply, lamination or cover 16 of comparatively soft, low flexural modulus resinous material ... is then <b>re-molded onto the inner ply or layer 14 ....</b>" (Nesbitt, col. 2, lines 43-47.)</p> <p>"[T]he outer layer or cover 16 <b>being of dimpled configuration....</b>" (Nesbitt, col. 2, lines 48-49; Fig. 2.)</p>
said outer layer comprising a polyurethane based material.	<p><b><u>Nesbitt Incorporates Materials of Molitor by Reference:</u></b></p> <p>"Reference is made to the application Ser. No. 155,658, of Robert P. Molitor issued into U.S. Pat. No. 4,274,637 which describes a number of foamable compositions of a character which may be employed for one or both layers 14 and 16." (Nesbitt, col. 3, lines 54-60.)</p> <p><b><u>Molitor '637:</u></b> Teaches cover materials including "polyurethanes such as are prepared from polyols and organic polyisocyanates"; specifically teaches Estane 58133 thermoplastic polyurethane. (Molitor '637, col. 5, lines 39-41; col. 18, lines 31-59 (examples 16 and 17).)</p>

## Invalidity Charts for U.S. Patent No. 6,210,293

Claim 5	Nesbitt
A golf ball according to claim 4	See above.
wherein said inner cover layer has a thickness of about 0.100 to about 0.010 inches	“It is found that the <b>inner layer</b> of hard, high flexural modulus resinous material such as Surlyn® resin type 1605, <b>is preferably of a thickness in a range of 0.020 inches and 0.070 inches.</b> ” (Nesbitt, col. 3, lines 19-23.)
and said outer cover layer has a thickness of about 0.010 to about 0.070 inches,	<p>“The <b>thickness of the outer layer or cover 16</b> of soft, low flexural modulus resin such as Surlyn type 1855, <b>may be in the range of 0.020 inches and 0.100 inches.</b>” (Nesbitt, col. 3, lines 22-25.)</p> <p>“The <b>outer layer</b> of the soft resin is of a <b>thickness of 0.0575 inches.</b>” (Nesbitt, col. 3, lines 39-40.)</p>
said golf ball having an overall diameter of 1.680 inches or more.	<p>“According to the United States Golf Association Rules, the <b>minimum diameter prescribed for a golf ball is 1.680 inches....</b>” (Nesbitt, col. 2, lines 50-52.)</p> <p>“This center or core 12 and inner layer 14 of hard resinous material in the form of a sphere is then remolded into a dimpled <b>golf ball of a diameter of 1.680 inches minimum</b> with an outer or cover layer 16 of a soft, low flexural modulus resin....” (Nesbitt (Ex. 10), col. 3, lines 34-38.)</p>

# **EXHIBIT 36**

**United States Patent** [19]**Molitor et al.**[11] **Patent Number:** **4,674,751**[45] **Date of Patent:** **Jun. 23, 1987**[54] **GOLF BALL HAVING IMPROVED  
PLAYABILITY PROPERTIES**[75] **Inventors:** Robert P. Molitor, Niles, Mich.;  
Terence Melvin, Sommers, Conn.;  
John L. Nealon, Springfield; David  
W. Dreifus, Longmeadow, both of  
Mass.[73] **Assignee:** Spalding & Evenflo Companies, Inc.,  
Chicopee, Mass.[21] **Appl. No.:** 858,958[22] **Filed:** May 2, 1986**Related U.S. Application Data**[63] **Continuation-in-part of Ser. No. 680,087, Dec. 10,  
1984, abandoned.**[51] **Int. CL<sup>4</sup>** ..... A63L 37/12[52] **U.S. CL** ..... 273/235 R; 273/218;  
273/DIG. 22; 273/DIG. 24; 525/127; 525/130[58] **Field of Search** ..... 525/127, 130; 273/218,  
273/233, 234, 235 R[56] **References Cited****U.S. PATENT DOCUMENTS**

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**Primary Examiner**—Lewis T. Jacobs**Assistant Examiner**—A. L. Carrillo**Attorney, Agent, or Firm**—Lahive & Cockfield[57] **ABSTRACT**

Disclosed is a golf ball having improved short iron and wood playability and improved puttability relative to conventional, ionomer covered balls. The golf balls comprise a novel cover which is far more durable than balata-covered balls yet closely approach or exceed their playability characteristics. The cover comprises a blend of a thermoplastic urethane having a Shore A hardness less than 95 and an ionomer having a Shore D hardness greater than 55. The relative amounts of the urethane and ionomer are set so that the cover has a Shore C hardness within the range of 70 to 85, most preferably 72 to 76.

**23 Claims, No Drawings**

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# GOLF BALL HAVING IMPROVED PLAYABILITY PROPERTIES

## REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of copending application Ser. No. 680 087 filed Dec. 10, 1984, now abandoned.

## BACKGROUND OF THE INVENTION

This invention relates to golf balls and more particularly to an improved golf ball cover useful in making balls, particularly two-piece balls, having superior short iron and other playability characteristics.

Balata and blends of balata with elastomeric or plastic materials were for many years the materials of choice in the manufacture of covers for top grade golf balls. These materials have good molding properties and accordingly could be readily compression molded about a spherical wound core to produce a high quality golf ball. An experienced player can apply spin to a balata covered wound ball such that it will fade or draw in flight or have the backspin necessary to stop abruptly on the green. These playability properties are most important in short iron play and can be exploited significantly only by relatively skilled players.

Balata and its synthetic substitutes, trans polybutadiene and trans polyisoprene, have today essentially been replaced by new materials. With the exception of a few lines of golf balls distributed through pro shops to professional golfers and those who would emulate them, newer synthetic polymers are the cover materials of choice.

Of the new synthetics, by far the most commonly used are a line of ionomers sold by E. I. DuPont de Nemours & Company under the trademark SURLYN. These materials comprise copolymers of olefins, typically ethylene, with an alpha, beta, ethylinically unsaturated carboxylic acid such as methacrylic acid. Metal ions such as sodium or zinc are used to neutralize some portion of the acidic groups in the copolymer resulting in a thermoplastic elastomer which has several advantages including a cost advantage over balata. The ionomers may be manufactured with a wide variety of properties by altering the identity of the comonomers, the fraction of the polymer comprising the carboxylic acid, the molecular weight of the polymer, the degree of neutralization of the polymer, and the identity of the metal ions used. Control of these parameters results in ionomer resins of different melt index, hardness, resilience and other mechanical properties which, in a golf ball cover, affect cut resistance, shear resistance, general durability, and resilience.

U.S. Pat. No. 3,819,768 to R. P. Molitor discloses that blends of sodium neutralized ionomer resins with zinc neutralized ionomer resins, as a class, have certain advantages which have not been achievable in any other way. Among these is the production of an unexpectedly high coefficient of restitution of golf balls having the blended ionomer cover. Such covers also resist cold cracking, have excellent aging properties, and are unexpectedly durable. The development of the SURLYN blended cover has been a major factor in the production of two-piece balls having covers which for all practical purposes cannot be cut in play, and which travel further when hit than any other USGA regulation ball as mea-

sured by controlled tests when hit by golfers or testing machines.

While the balata-covered, thread-wound balls are easily cut and very expensive, they nevertheless have excellent short iron playability. It is much more difficult to impart spin to an ionomer covered two-piece ball. Frequently, experienced players note that the ionomer covered two-piece balls have an unsatisfactory "feel".

The patent literature is replete with proposed cover formulations seeking to improve upon the balata and ionomer covers which have been commercially successful. Polyurethanes, thermoplastic rubbers, various block copolymers, polyesters, and polyamides, as well as various blends including such materials, have been proposed. Examples include: U.S. Pat. Nos. 3,359,231, 4,398,000, 4,234,184, 4,295,652, 4,248,432, 3,989,568, 3,310,102, 4,337,947, 4,123,061, and 3,490,246.

The manufacture of two-piece balls i.e., balls comprising a solid, molded, resilient core and a cover, has many significant advantages over the more expensive wound balls. There is accordingly a need for two-piece balls having short iron playability characteristics comparable to wound, balata-covered balls. Such covers must have an appropriate hardness to permit the accomplished golfer to impart proper spin. In addition, it should have a resilience when formulated to have the proper hardness value consistent with a high coefficient of restitution. Also, it must be readily manufactured in large volumes at low cost, have an appropriate specific gravity, and have a desirable white color.

## SUMMARY OF THE INVENTION

It has now been discovered that a key to manufacturing a two-piece ball having playability properties similar to wound, balata-covered balls is to provide about an inner resilient molded core a cover having a shore C hardness less than 85, preferably 70-80, and most preferably 72-76. The novel cover of the golf ball of the invention is made of a composition comprising a blend of (1) a thermoplastic urethane having a shore A hardness less than 95 and (2) an ionomer having a shore D hardness greater than 55. The ionomer comprises olefinic groups having two to four carbon atoms copolymerized with acrylic or methacrylic acid groups and cross-linked with metal ions, preferably sodium or zinc ions. The primary components of the blended cover are set at a weight ratio so as to result in a cover material after molding having a shore C hardness within the range of 70 to 85, preferably 72 to 76. Preferably, the urethane component of the cover material has a tensile strength greater than 2500 psi and an elongation at break greater than 250%. A preferred cover material comprises about 8 parts of the thermoplastic urethane and between 1 and 4 parts ionomer. Preferably, the cover is no greater than 0.060 inch thick. Thinner covers appear to maximize the short iron Playability characteristics of the balls.

The cover composition of the invention may be used in connection with the manufacture of thread-wound balls, but is preferably used in the manufacture of balls having molded cores. Two-piece balls made with the cover of the invention have short iron playability properties as good as or better than balata-covered wound balls but are significantly more durable. They also have better wood playability properties than conventional two-piece balls, and permit experienced golfers to apply spin so as to fade or draw a shot. Puttability is also improved.

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Tests have shown that the spin rate off a nine iron of two-piece balls comprising the cover material of the invention is about 9,550 rpm vs. about 5,400 rpm for state of the art, two-piece balls having ionomer covers. This compares favorably to balata-covered wound balls which under the same hitting conditions have a spin rate of about 9,700 rpm. The phrase "two-piece ball" as used herein refers primarily to balls consisting of a molded core and a cover, but also includes balls having a separate solid layer beneath the cover as disclosed, for example, in U.S. Pat. No. 4,431,193 to Nesbitt, and other balls having non-wound cores.

The increased spin that can be applied during a proper hit to balls having the cover of the invention is believed to be due primarily to the softness of the blended cover material. On impact, the cover deforms significantly more than balls having ionomer covers, and tests have shown that there is a greater area of contact between the ball and the club face. This permits the better player to impart fade, draw, or backspin to the ball as the situation dictates, and permits the player to execute better chips and other shots to the green. On shots of short-range, e.g., less than 50 yards, the two-piece balls of the invention often outperform balata-covered wound balls. Regarding puttability, two-piece balls including the cover of the invention have a lower drop rebound relative to conventional two-piece balls, and have increased contact time on the putter face. These characteristics combine to enable the player better to control the putting line and distance.

The preferred components of the cover material comprise a thermoplastic polyurethane consisting essentially of linear primary polymer chains. The structure of such chains preferably comprises long, flexible chain segments joined end to end by rigid chain segments through covalent chemical bonds. The flexible segments typically are diisocyanate-coupled, low melting polyester or polyether chains. The rigid segments include single diurethane bridges and high melting urethane chain segments formed by the reaction of diisocyanate with small glycols. Hydrogen bonding and other attractive forces among the rigid chain segments are believed to produce domains which are mutually attractive, behave somewhat like cross-links, and are reversible with heat and with solvation.

The preferred second component of the cover composition is an ionomer comprising olefinic groups having two or four carbon atoms copolymerized with acrylic or methacrylic acid groups which are at least partially neutralized with a sodium or zinc ion, e.g., a SURLYN ionomer. Inclusion of the ionomer imparts to the cover a degree of cut resistance far in excess of balata and helps to control the melt index of the blend to facilitate molding.

The cover composition of the invention may be used to formulate golf ball covers by injection or compression molding about wound cores, solid molded cores of known composition, high coefficient molded cores such as those disclosed in copending application Ser. No. 680,088, filed Dec. 10, 1984, or cores or the type claimed in copending application Ser. No. 680,085, filed Dec. 10, 1984, which has an inner, hard central portion and a soft outer layer. Various combinations of the solid core technologies may also be used.

Accordingly, it is an object of the invention to provide a cover composition which can be injection molded or compression molded about a solid molded core to produce golf ball covers which are more dura-

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ble and cut resistant than balata rubber-covered balls. Another object is to provide a two-piece ball having short iron and other playability characteristics equal to or exceeding thread-wound balata-covered balls. Another object is to provide a cover composition compatible with urethane-based paints which resists chipping and peeling. Another object is to produce a cover for a two-piece ball which may be easily manufactured to be cut resistant and to have an improved combination of hardness and resilience properties, thereby providing a two-piece ball having both high resilience and short iron playability.

These and other objects and features of the invention will be apparent from the following description and from the claims.

#### DESCRIPTION

The cover composition of the invention in its broadest aspects comprises a blend of a thermoplastic urethane having a shore A hardness less than 95 together with an ionomer resin having a shore D hardness greater than 55 at weight ratios sufficient to result in a golf ball cover having a shore C hardness within the range of 70 to 85, preferably within the range of 70 to 80, and most preferably 72 to 76.

The thermoplastic urethanes useful in the cover preferably consist essentially of linear primary polymer chains having a preponderance of relatively long, flexible chain segments joined end to end by rigid chain segments through covalent chemical bonds. The flexible segments may be diisocyanate coupled, low melting polyester or polyether chains. The rigid segments include single diurethane bridges resulting when a diisocyanate couples to polyester or polyether molecules. The rigid segments may comprise longer high melting urethane chain segments formed by the reaction of diisocyanate with a low molecular weight glycol chain extender component.

The polar nature of the recurring rigid, urethane chain segments results in their strong mutual attraction, aggregation, and ordering into crystalline and polycrystalline domains in the mobile polymer matrix. Urethane hydrogen atoms and carbonyl and ether oxygen partners are believed to permit extensive hydrogen bonding among the polymer chains. This apparently restricts the mobility of the urethane chain segments in the domains. These attractions and chain entanglements produce thermo-labile pseudo cross-links and produce resins which can display the superficial properties of strong rubbery vulcanizates. Preferred thermoplastic urethanes in the cover composition of the invention have a tensile strength of at least 2500 lb/in<sup>2</sup> and an elongation at break of at least 250 percent. Most preferably, tensile strength and elongation at break are 4000 lb/in<sup>2</sup> and 400 percent, respectively.

Such materials are available commercially from Mobay Chemical Company under the trademark TEXIN, from B.F. Goodrich under the trademark ESTANE, from Upjohn Company under the trademark PELLETHANES, or from K.J. Quinn Company under the trademark Q THANES. Mobay Chemical Company's TEXIN 480AR is the currently preferred thermoplastic urethane for use in the composition of the invention. TEXIN 591A may also be used.

The other major component of the cover composition is an ionomer resin comprising a copolymer of an olefin having one to four carbon atoms with a monocarboxylic, typically acrylic or methacrylic, acid, at least

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partially neutralized with a metal ion. These materials are sold under the trademark SURLYN by E.I. DuPont de Nemours Co. and, as noted previously, come in a wide variety of grades which differ in average molecular weight, percent carboxylic acid monomer, degree of neutralization, identity of neutralizing ion, and other factors. Any of the SURLYN ionomers or other ionomers of the type described having a shore D hardness of at least 55 may be used. The currently preferred material is SURLYN 1702. SURLYN 1702 is a copolymer of ethylene and methacrylic acid which is believed to comprise about 96.5% free acid and 1.2% zinc. Its average melt index is about 14.

The presence of the ionomer in the blend serves to set the melt flow index to optimal levels for injection or compression molding and also imparts cut resistance and general durability to covers made with the blend.

The urethane and ionomer resin components thus coact in use to provide a unique combination of durability, playability, and ease of manufacture. The rheological properties of the blend when melted are well suited for molding covers on a commercial scale. The blend is naturally white enough so that with proper pigment additives the balls may be clear coated without painting. The nature of the cover material is such that better players can fade, draw, or apply backspin to the ball even though it is of two-piece construction, yet the cover is more cut resistant and has generally better durability than balata-covered wound balls. It is believed that the primary reason why more spin can be given to the ball during a hit is that the cover material deforms more easily than do ionomer covers. Thus, irons, particularly short irons, tend to "bite" into the ball without permanently deforming it.

The nature of the molded cores which may be used with the cover form no part of this invention, although molded cores are preferred over wound cores because of their lower cost and superior performance. Thus the covers of the invention may be used with cores of the type described in U.S. Pat. Nos. 4,264,075, 4,169,599, or 4,141,559.

Conventional solid cores are typically compression molded from a slug of uncured or lightly cured elastomer composition comprising a high cis content polybutadiene and a metal salt of an alpha, beta, ethylenically unsaturated carboxylic acid such as zinc mono or di acrylate or methacrylate. To achieve high coefficient of restitution in the core, manufacturer include a small amount of a metal oxide such as zinc oxide. Larger amounts of metal oxide than are needed to achieve coefficient may be included to increase core weight so that the finished ball more closely approaches the USGA upper weight limit of 1.620 ounce. Other materials may be used in the core composition including compatible rubbers or ionomers, and low molecular weight fatty acids such as stearic acid. Free radical initiator catalysts such as peroxides are admixed with the core composition so that, on the application of heat and pressure, a complex curing or cross-linking reaction takes place.

Copending application Ser. No. 680,088, filed on the same day as the parent of this application, discloses a golf ball core that is cured with a peroxide and a polyfunctional isocyanate. Balls having cores made using a small amount of such as isocyanate, preferably a diiso-

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cyanate, e.g., 1.0%, 4,4' diphenyl methane diisocyanate, have an improved, higher coefficient of restitution. Coefficient of restitution is defined as the ratio of outgoing to incoming velocity of the test core or ball projected against a hard Plate at a selected initial velocity, e.g., 125 ft./sec. The composition may otherwise be identical to prior art polybutadiene-metal acrylate core compositions. These cores may be used with the cover composition of the invention to produce a ball of high coefficient and high initial velocity, closely approaching the USGA limit, which nevertheless has excellent short iron playability properties.

Copending application Ser. No. 680,088, filed on the same day as the parent of this application, discloses a core consisting of a hard, inner central portion and a softer outer layer. The core may be manufactured by formulating a conventional core composition of the type described above, extruding slugs of the proper size, applying a material which alters cross-linking to surface layers of the slug, e.g., sulfur or sulfur bearing materials, and then compression molding. Inner portions of the core cure in the normal way to produce a hard, resilient center. An outer layer of the core, at least about 0.20 inches thick, is cured differently because of the presence of the sulfur or sulfur bearing material to produce a soft outer region, e.g., having a Shore A hardness of about 35. This type of core may also be used with the cover of this invention to produce balls of excellent short iron playability characteristics.

The invention will be further understood from the following non-limiting examples.

A cover composition according to the present invention was made by blending 80 parts TEXIN 480AR thermoplastic urethane (Mobay), 20 parts SURLYN 1702 (Dupont) and 0.4 parts TiO<sub>2</sub>. After thorough blending, the cover stock had a melt flow index of 0.89. It was injection molded about conventional cores of the type described above at approximately 450 degrees F. to produce covers 0.060 in. thick. The balls were painted and their properties were tested versus a golf ball of similar construction, except that the cover material was a blend of a sodium ionomer with a zinc ionomer, and versus a wound ball having a balata cover.

Off a nine iron, balls having the cover of the invention had a spin rate of 9550 rpm, whereas ionomer covered balls had a spin rate of 5400 rpm and the balata covered balls a spin rate of 9700 rpm. When "bladed" with a three iron, the balls of the invention are very slightly bruised, the ionomer covered balls are unmarked, and the balata covered ball is cut through to the threads. When tested by professional golfers, the balls of the invention were perceived as being equal or superior to balata covered balls for short iron playability.

A series of cover formulations were made and molded about identical one-piece cores. In these examples, the type of thermoplastic urethane and the type of ionomer used in the blend was varied, or one of two components was eliminated, to demonstrate the effect on hardness and coefficient of the resulting golf balls. The examples also provide further teaching to those skilled in the art in the formulation of covers embodying the invention. The covers were manufactured generally as set forth in the example above using the ingredients and yielding the results set forth below.

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TABLE

	Sample No.											
	1	2	3	4	5	6	7	8	9	10	11	12
<b>Cover</b>												
Texin 480 AR (86 ± 3) <sup>1</sup>	100	—	—	90	80	70	80	80	—	—	—	—
Surlin 1702 (62) <sup>2</sup>	—	—	—	10	20	30	—	—	10	10	20	20
Surlin 1706 (64) <sup>2</sup>	—	—	—	—	—	—	20	—	—	—	—	—
Surlin 1605 (65) <sup>2</sup>	—	—	—	—	—	—	—	20	—	—	—	—
Elastollan 90 (90) <sup>1</sup>	—	100	—	—	—	—	—	—	90	—	80	—
Goodrich X-4128 (93) <sup>1</sup>	—	—	100	—	—	—	—	—	—	90	—	80
Titanium dioxide	5	5	5	5	5	5	5	5	5	5	5	5
Fluorescent brightener	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Antioxidant	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Pigment	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Release agent	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
<b>Finished Ball Data</b>												
Weight	45.2	45.3	44.9	45.1	44.7	44.5	45.0	44.8	45.1	44.8	44.4	44.5
Compression	74	70	72	72	70	73	73	70	69	71	72	74
Coefficient	.791	.788	.793	.791	.794	.787	.793	.795	.789	.790	.785	.789
Shore C Hardness	69	80	74	71	73	76	73	73	82	76	84	78

<sup>1</sup>Shore A hardness.<sup>2</sup>Shore D hardness; Elastollan 90A is a thermoplastic polyester-type urethane available commercially from BASF; Goodrich X-4128 is a thermoplastic polyester-type urethane available commercially from B. F. Goodrich.

Cover sample number 4 is most preferred. Samples Nos. 1, 2, and 3 are not embodiments of the invention. Sample No. 6 presented molding difficulties. Sample No. 7, 8, and 10 constitute preferred embodiments, with a Shore C hardness within the range of 72–76. Sample 4 illustrates a soft covered ball exemplifying the lower range of softness in covers embodying the invention. Samples 9, 11 and 12 illustrate hard covered balls exemplifying the upper range of softness in covers embodying the invention.

It should be understood that other materials may be included in the cover in addition to the essential urethane and ionomer resins discussed above, provided the cover is formulated to have the requisite Shore C hardness. For example, the hardness of a given cover embodying the invention may be adjusted slightly, and its other properties may be modified by introducing into the blend compatible thermoplastic resins such as polycarbonates.

The invention may be embodied in other specific forms without departing from the spirit and scope thereof. Accordingly, other embodiments are within the following claims.

What is claimed is:

1. A composition of matter for molding a cover for a golf ball, said composition comprising a thermoplastic urethane polymer and said having a Shore A hardness less than 95 and an ionomer comprising olefinic groups having 2 to 4 carbon atoms copolymerized with a monocarboxylic acid having 3 to 4 carbon atoms, said acid groups being at least partially neutralized with a metal ion, said ionomer having a Shore D hardness greater than 55, the relative amounts of said urethane polymer and said ionomer being sufficient to produce a cover having a Shore C hardness within the range of 70 to 85.

2. The composition of claim 1 wherein the relative amounts of said urethane polymer and said ionomer are sufficient to produce a cover having a Shore C hardness within the range of 70 to 80.

3. The composition of claim 1 wherein the relative amounts of said urethane polymer and said ionomer are sufficient to produce a cover having a Shore C hardness within the range of 72 to 76.

4. The composition of claim 1 wherein said ionomer is neutralized with a metal selected from the group consisting of sodium and zinc.

5. The composition of claim 1 comprising 8 parts of said urethane polymer and between 1 and 4 parts of said ionomer.

6. The composition of claim 1 further comprising titanium dioxide.

7. The composition of claim 1 wherein said urethane polymer has a tensile strength of at least 2500lb/in<sup>2</sup> and an elongation at break greater than 250 percent.

8. In a golf ball having a core and a cover, the improvement wherein the cover comprises a blend of a thermoplastic urethane polymer having a Shore A hardness less than 95 and an ionomer having a Shore D hardness greater than 55, said ionomer comprising olefinic groups having 2 to 4 carbon atoms copolymerized with acrylic or methacrylic acid groups, said acid groups being at least partially neutralized with a metal ion, the relative amounts of said urethane polymer and said ionomer being sufficient to produce a cover having a Shore C hardness within the range of 70 to 85.

9. The improvement of claim 8 wherein the relative amounts of said urethane polymer and said ionomer are sufficient to produce a cover having a Shore C hardness within the range of 70 to 80.

10. The improvement of claim 8 wherein the relative amounts of said urethane polymer and said ionomer are sufficient to produce a cover having a Shore C hardness within the range of 72 to 76.

11. The improvement of claim 8 wherein said core comprises a molded, resilient, solid sphere.

12. The improvement of claim 8 wherein said ionomer is neutralized with a metal selected from the group consisting of sodium and zinc.

13. The improvement of claim 8 comprising 8 parts of said urethane polymer and between 1 and 4 parts of said ionomer.

14. The improvement of claim 13 comprising about 2 parts of said ionomer.

15. The improvement of claim 8 wherein said cover has a thickness no greater than 0.60 inch.

16. The improved golf ball of claim 8 characterized in that it has a spin rate when hit with a nine iron greater than 9,000 rpm.

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17. A golf ball cover comprising a blend of a thermoplastic urethane polymer having a Shore A hardness less than 95 and an ionomer comprising olefinic groups having 2 to 4 carbon atoms copolymerized with a monocarboxylic acid having 3 to 4 carbon atoms, said acid groups being at least partially neutralized with a metal ion, said ionomer having a Shore D hardness greater than 55, the relative amounts of said urethane polymer and said ionomer being sufficient to produce a cover having a Shore C hardness within the range of 70 to 85.

18. The cover of claim 17 wherein the relative amounts of said urethane polymer and said ionomer are sufficient to produce a cover having a Shore C hardness within the range of 70 to 80.

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19. The cover of claim 17 wherein the relative amounts of said urethane polymer and said ionomer are sufficient to produce a cover having a Shore C hardness within the range of 72 to 76.

20. The cover of claim 17 wherein said ionomer is neutralized with a metal selected from the group consisting of sodium and zinc.

21. The cover of claim 17 comprising 8 parts of said urethane polymer and between 1 and 4 parts of said ionomer.

22. The cover of claim 17 further comprising titanium dioxide.

23. The cover of claim 17 wherein said urethane polymer has a tensile strength of at least 2500 lb/in<sup>2</sup> and an elongation at break greater than 250 percent.

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# **EXHIBIT 37**



US005314187A

**United States Patent** [19][11] Patent Number: **5,314,187****Proudfit**[45] Date of Patent: **May 24, 1994**

[54] **GOLF BALL WITH IMPROVED COVER**  
 [75] Inventor: **James R. Proudfit, Humboldt, Tenn.**  
 [73] Assignee: **Wilson Sporting Goods Co., Chicago, Ill.**  
 [21] Appl. No.: **905,895**  
 [22] Filed: **Jun. 29, 1992**

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**Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 733,789, Jul. 26, 1991, abandoned.

[51] Int. Cl.<sup>3</sup> ..... **A63B 37/12**  
 [52] U.S. Cl. .... **273/235 R; 273/233; 273/218; 273/228; 273/DIG. 22; 525/193; 525/123; 525/236; 264/250**  
 [58] Field of Search ..... **525/193, 123, 236; 273/235 R, 230, 218, 233**

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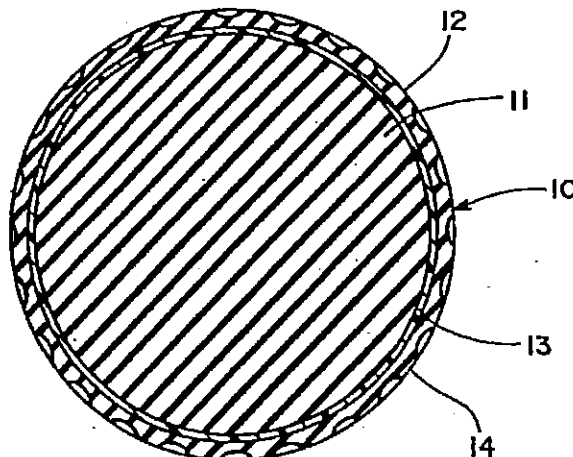
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*Assistant Examiner*—J. Zemel

[57] **ABSTRACT**

A golf ball includes a core and a cover which is formed from two separate inner and outer layers. The inner layer is molded over the core and is formed from ionomer resin. The outer layer is molded over the inner layer and is formed from a blend of natural or synthetic balata and a crosslinkable elastomer such as polybutadiene. The elastomer is thermally crosslinked with a metallic salt of an unsaturated fatty acid, such as zinc diacrylate, and a crosslinking initiator such as organic peroxide.

**25 Claims, 3 Drawing Sheets****AC 0015574**

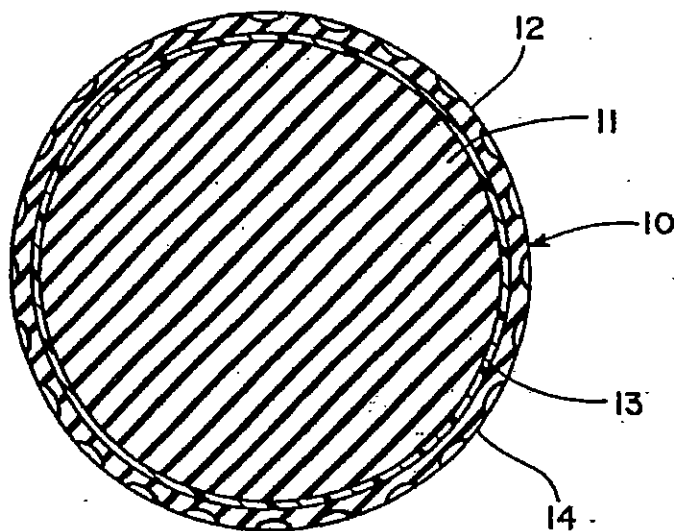
U.S. Patent

May 24, 1994

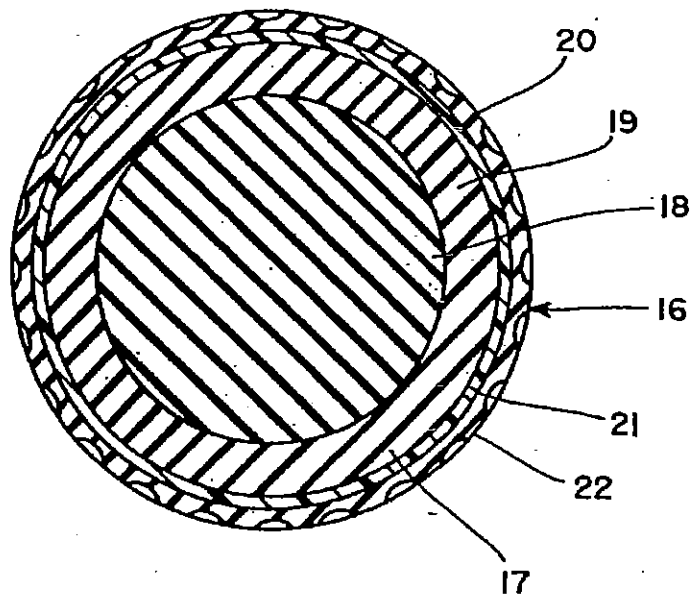
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**Fig. 1**



**Fig. 2**



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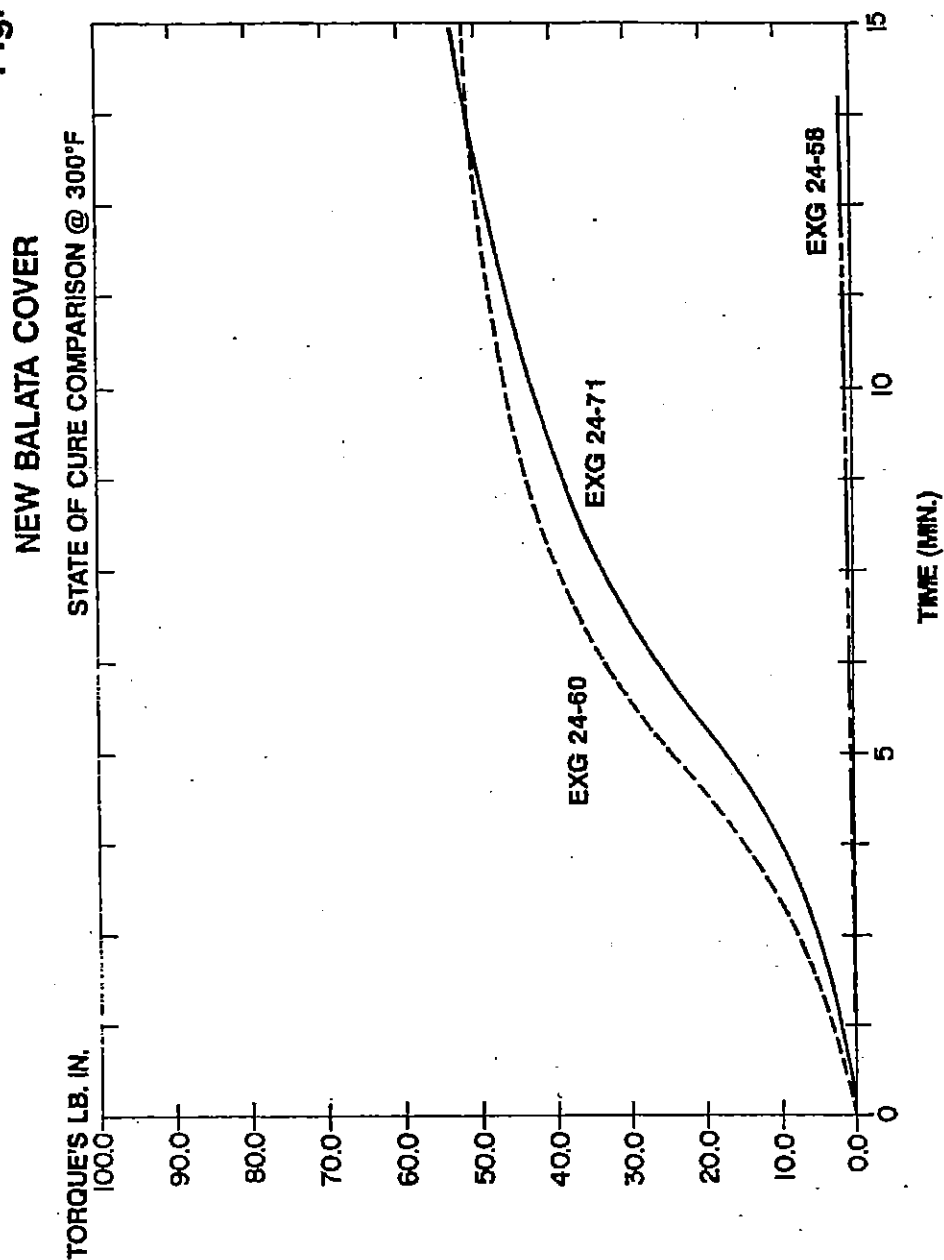
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Fig. 3



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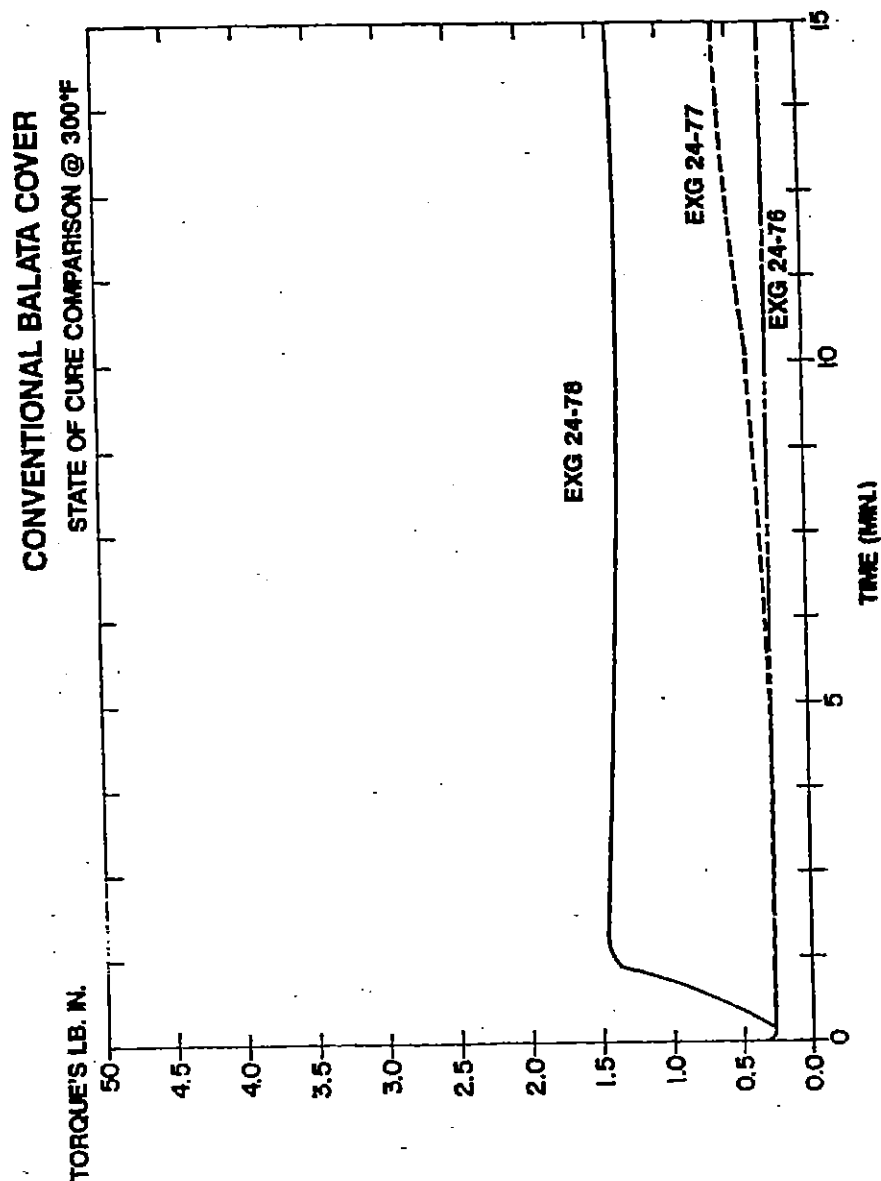
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Fig. 4



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## GOLF BALL WITH IMPROVED COVER

## RELATED APPLICATION

This application is a continuation-in-part application of my co-pending application entitled "Golf Ball with Improved Cover," Ser. No. 733,789, filed Jul. 26, 1991, now abandoned.

## BACKGROUND

This invention relates to golf balls, and, more particularly, to a golf ball having a two-layer cover. The inner layer is formed from hard resin material such as ionomer resin, and the outer layer is formed from soft material such as balata or a blend of balata and other elastomers.

Golf balls which are currently available fall into two general categories—balls which include a balata cover and balls which include a more durable, cut-resistant cover. Balata covers are made from natural balata, synthetic balata, or a blend of natural and synthetic balata. Natural rubber or other elastomers may also be included. Synthetic balata is trans polyisoprene and is commonly sold under the designation TP-301 available from Kuraray Isoprene Company Ltd.

Most cut-resistant covers utilize Surlyn ionomers, which are ionic copolymers available from E. I. du Pont de Nemours & Co. Surlyn ionomers are copolymers of olefin, typically ethylene, and an alpha-beta ethylenically unsaturated carboxylic acid, such as methacrylic acid. Neutralization of a number of the acid groups is effected with metal ions, such as sodium, zinc, lithium, and magnesium. DuPont's U.S. Pat. No. 3,264,272 describes procedures for manufacturing ionic copolymers. Ionic copolymers manufactured in accordance with U.S. Pat. No. 3,264,272 may have a flexural modulus of from about 14,000 to about 100,000 psi as measured in accordance with ASTM method D-790. DuPont's U.S. Pat. No. 4,690,981 describes ionic copolymers which include a softening comonomer. Ionic copolymers produced in accordance with U.S. Pat. No. 4,690,981 are considered "soft" ionic copolymers and have a flexural modulus of about 2800 to about 8500 psi.

Other cut-resistant materials which can be used in golf ball covers are ionic copolymers available from Exxon under the name Iotek, which are similar to Surlyn ionic copolymers except that acrylic acid is used rather than methacrylic acid.

A number of golfers, primarily professional and low handicap golfers, prefer balata covered balls because of the higher spin rate, control, "feel," and "click" which balata provides. "Feel" is the overall sensation imparted to a golfer when the ball is hit, and "click" refers to the sound made when the clubhead hits the ball. However, balata covered balls are more expensive and are less resistant to cutting than Surly covered balls.

Conventional balata covered 3 piece golf balls are produced by winding resilient, low heat-resistant elastic thread over a soft rubber or liquid rubber center, which must first be frozen to permit winding the rubber thread, and molding a conventional soft balata cover over the windings. The balata is conventionally vulcanized or crosslinked by using sulfur as the crosslinker or vulcanizing agent.

This process has proven to be very costly and requires numerous extra production steps in manufacture, extended cure time frames in hot room areas, and specified ambient conditions in order to complete the sulfur

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crosslinking system. The procedures limit the consistency of the crosslinking, reduce the ability to initiate good work-in-process production procedures and maintain normal inventory levels, and limit the time frame after ball finishing for final cover crosslinking which develops the final physical properties of the cover and the ball.

In addition, conventional processing methods for balata covered balls produce relatively low yields of good cosmetic quality balls because the additional processing steps which are required before complete cover crosslinking occurs can damage the cover surface. Also, extra steps are required in conventional balata ball production methods including chlorination and ball rinses to prepare the cover surface for acceptable paint adhesion to the balata surface. Multiple coats of pigmented paint are normally applied prior to logo stamping, then a final clear, two component or ultra violet curable coating is applied to protect the ball surface and logo.

While the ball is played, additional paint durability problems may be exhibited in the form of scuffing and micro cracking. Balata golf balls produced using the conventional process methods also suffer from color and color stability problems.

Surlyn covered balls are cheaper than balata balls not only because Surlyn is cheaper than balata but because the Surlyn balls can be processed after molding much easier and faster than balata balls. The substantial processing differences between balata balls and Surlyn balls can be seen by comparing Tables 1 and 2, which describe the conventional processing steps for manufacturing 3 piece balata and 3 piece Surlyn golf balls. The term "3 piece" is commonly used to refer to a golf ball which has a center, a layer of elastic windings over the center, and a cover. The term "2 piece" is used to refer to a golf ball which has a solid core and a cover. Table 3 describes the conventional processing steps for a 2 piece Surlyn golf ball. The processing steps described in Tables 1-3 are well known in the golf ball industry, and a detailed description thereof is unnecessary.

TABLE 1

## Conventional 3 Piece Balata Process

1. center rubber compound mixed
2. mill and preform pellets
3. mold center
4. center flash removed
5. freeze center
6. wind core (conventional elastic thread)
7. compression mold heated preform pellets into single halfshells
8. place halfshells over wound core
9. compression mold balata balls Note: cover is only partially crosslinked after this molding step.
10. freeze molded ball prior to buffing
11. remove balls and transfer to fiberglass bags
12. transport frozen balls to holding freezer
13. seam buff ball being careful not to buff seam too deep because of the soft cover
14. grade balls after seam buff for quality level
15. cure balata ball cover in alcohol/RR2 crystals solution, (7 hours soak)
16. remove balls from solution and water rinse
17. transport balls into hot room to cure for 7 days
18. before removing balls from room use benzene test method to insure proper cover cure

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19. remove balls from cure room and soak in acetone, (hazard solvent disposal necessary)
20. remove balls from acetone and allow to air dry
21. chlorination process using hydrochloric acid and sodium hypochlorite; load balls into solution tank (must be done in an exhausted area for safety), (chlorination solution must be neutralized before discharge into city sewer drain)
22. remove balls and rinse in clear water tank, up and down motion
23. remove and repeat in second tank
24. remove and repeat in third tank
25. remove and rinse in acetone tank
26. apply primer
27. apply 1st top coat
28. pad print logo
29. apply clear top coat
30. inspect and package

TABLE 2

## Conventional 3 Piece Surlyn Process

1. center rubber compound mixed
2. mill and preform slug
3. mold center
4. center flash removed
5. wind center (conventional elastic thread)
6. injection mold halfshells
7. place halfshells over core
8. compression mold ball
9. seam buff parting line
10. vibratory finish ball
11. apply primer
12. pad print logo
13. apply clear top coat
14. inspect and package

TABLE 3

## Conventional 2 Piece Surlyn Process

1. core rubber compound mixed
2. mill and preform slug
3. mold core
4. centerless grind core to size
5. injection mold Surlyn cover around core
6. seam buff parting line
7. vibratory finish ball
8. apply primer
9. pad print logo
10. apply clear top coat
11. inspect and package

The balata cover is not fully cured and crosslinked until the 7 day cure step of step No. 17 in Table 1 is completed. As a result, the partially cured balata balls require more careful handling and additional process steps than the Surlyn balls. For example, after the balata balls are removed from the mold they must be frozen before the parting line seam on each ball is buffed. Also, because the balata covers are softer, they must be examined more carefully for defects which could be caused by the processing steps.

## DESCRIPTION OF PRIOR ART GOLF BALL CURING SYSTEMS

As stated previously, balata covers are generally vulcanized or cured using sulfur as the vulcanizing agent. Sulfur is included in the cover composition in an amount of about 1 to 2% by weight of the balata. The vulcanizing occurs during the final molding operation in which two hemispherical halfshells of the cover are

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molded over the thread-wound core in a compression mold. However, the molding temperature and time is limited by the threads, which can be damaged by high heat. Accordingly, the cover is not fully cured when it is removed from the mold and requires the exposure as described in Table 1, step 15 to accelerate the cure through migration of the RR2 crystals accelerator material into the cover cross sectional area to complete the vulcanization of the cover. RR2 crystals are the reaction product of 1,1 methylene dipiperidine and carbon disulfide and are available from Rockland React-Rite, Inc. of Rockmart, Ga. RR2 crystals are dissolved in isopropyl alcohol solvent in the amount of about 10% by weight of crystals to about 90% by weight of alcohol.

By way of example, one specific commercial balata covered ball which was sold by Wilson Sporting Goods Co. had the cover composition described in Table 4.

TABLE 4

Prior Art Balata Cover Composition (Parts by Weight)	
Trans Polyisoprene	84.00
Natural Rubber or Polyisoprene	16.00
ZnO	13.00
TiO <sub>2</sub>	17.00
Blue Toner	0.20
Stearic Acid	0.26
Thiozole Accelerator	0.26
Sulfur	1.20
Total	131.92

This system was not completely crosslinked until steps 15 through 17 were performed in Table 1.

The Zinc Oxide was used as a filler and a gravity adjuster. The blue toner was used to enhance the white color and was Ultramarine Blue from Whittaker, Clark & Daniels, Inc. of South Plainfield, N.J.

Two piece or solid golf balls conventionally include a core which includes a thermally crosslinkable elastomer such as polybutadiene. The polybutadiene is cured or crosslinked by including in the core composition a crosslinking agent and a crosslinking initiator. Common crosslinking agents are zinc salts of monocarboxylic acids such as zinc diacrylate, zinc acrylate, and zinc methacrylate. The crosslinking initiator provides free radicals, and common crosslinking initiators are organic peroxides such as dicumyl peroxide.

U.S. Pat. Nos. 3,784,209, 4,065,537, 4,266,772, 4,483,537, 4,683,257, 4,688,801, 4,714,253, and 4,715,607 describe various solid cores for golf balls which include elastomers such as polybutadiene which are cured or crosslinked by zinc diacrylate and peroxide or similar ingredients.

U.S. Pat. Nos. 4,792,141 and 4,931,376 describe golf ball covers which include blends of balata and elastomers such as polybutadiene and trans polyoctenylene rubber. However, the rubber compositions are cured by the conventional sulfur curing technique.

U.S. Pat. No. 4,884,814 describes a golf ball cover which is formed from a blend of "hard Surlyn" and "soft Surlyn". The hard Surlyn is described as a high modulus ionomer having a flexural modulus of from about 30,000 to 55,000 psi as measured in accordance with A.S.T.M. Method D-790. The soft Surlyn is described as a low modulus ionomer having a flexural modulus of from about 3,000 to about 7,000 psi.

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U.S. Pat. No. 4,431,193 describes a golf ball with a two-layer cover. The inner layer is formed from a hard ionomer resin having a high flexural modulus, and the outer layer is formed from a soft ionomer resin having a low flexural modulus.

#### SUMMARY OF THE INVENTION

The invention provides a golf ball which has many of the desirable features of balata covered balls but is more durable, more cut-resistant, and easier and less expensive to manufacture than conventional balata covered balls.

A golf ball cover in accordance with the invention includes an inner layer formed from a relatively hard, cut-resistant material such as ionomer resin and an outer layer of soft material such as balata or a blend of balata and other elastomers. Preferably, the outer layer is a blend of balata and a thermally crosslinkable elastomer such as polybutadiene. The balata and elastomer are crosslinked during the molding of the ball by a crosslinker such as zinc diacrylate and a crosslinking initiator such as organic peroxide rather than using the conventional sulfur and RR2 crystals curing system for balata covers. The outer layer of the cover is completely crosslinked when the ball is removed from the mold, and subsequent processing steps can be performed in the same manner as on Surlyn covered balls. The inner layer of the cover provides good cut resistance, and the outer layer provides the sound, feel, and spin characteristics of a balata cover. The cover can be used in either 2 piece or 3 piece balls.

#### DESCRIPTION OF THE DRAWING

FIG. 1 is a cross section of a two piece ball formed in accordance with the invention;

FIG. 2 is a cross section of a three piece ball formed in accordance with the invention; and

FIGS. 3 and 4 are rheology charts showing curing comparisons of various balata covers.

#### DESCRIPTION OF SPECIFIC EMBODIMENTS OF THE INVENTION

The cover of the invention is formed from two layers—an inner layer which is molded over a solid or a wound core and an outer layer which is molded over the inner layer. The inner layer is formed from a relatively hard, cut-resistant material such as ionomer resin, and the outer layer is formed from relatively soft material such as elastomeric or polymeric material selected from the class consisting of natural balata, synthetic balata, natural rubber, polybutadiene, and polyoctenylene rubber. Polyoctenylene rubber having a high trans content is available under the trade name Vestenamer from Huls Corp. of West Germany. Particular grades of Vestenamer which are suitable are Vestenamer 8012 and Vestenamer 6213.

The ionomers used for the inner layer are available from E. I. du Pont de Nemours & Co. under the name Surlyn and from Exxon under the name Iotek. Surlyn resins are described in U.S. Pat. No. 3,264,272. As described in that patent, various metal ions can be used to neutralize the acid groups, including sodium, zinc, lithium, and magnesium. The ionomer resins generally fall into three categories which are characterized by hardness or stiffness—standard, high modulus, and low modulus. The standard resins have a flexural modulus in the range of about 30,000 to about 55,000 psi as measured by ASTM Method D-790. (Standard resins are referred to

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as "hard Surlyns" in U.S. Pat. No. 4,884,814.) The high modulus resins have a flexural modulus in the range of about 55,000 to about 100,000 psi. The low modulus resins have a flexural modulus in the range of about 2800 to about 8500 psi.

Specific standard Surlyn resins which can be used in the inner layer include 8940 (sodium), 9910 (zinc), 7930 (lithium). Specific standard Iotek resins which can be used include 8000 (sodium), 8020 (sodium), 8030 (sodium), 4000 (zinc), and 4010 (zinc).

Low modulus ionomers are described in U.S. Pat. No. 4,690,981 and include a softening comonomer. Specific low modulus Surlyns which can be used in the inner layer include 8120 (sodium), 8320 (sodium), and 9320 (zinc).

Specific high modulus Surlyns which can be used in the inner layer include 8220 (sodium), 8240 (sodium), 9220 (zinc), and AD-8181 (lithium).

The ionomer resins can be used alone or in blends of two or more types of ionomers, for example, blends of sodium/zinc ionomers, sodium/lithium ionomers, zinc/lithium ionomers, and sodium/zinc/lithium ionomers. Blends of ionomers of different stiffness can also be used, for example, blends of standard/high modulus ionomers, standard/low modulus ionomers, low/high modulus ionomers, and low/standard/high modulus ionomers.

The relatively soft elastomeric material of the outer layer has a flexural modulus in the range of about 20,000 to 25,000 psi, and in one specific embodiment had a flexural modulus of from 22,165 to 22,379 psi.

The outer layer preferably comprises a blend of balata and one or more thermally crosslinkable elastomeric polymers. The balata can be either natural or synthetic balata or a blend of both. The thermally crosslinkable elastomers can be those which have heretofore been used in core compositions of golf balls, for example, as described in U.S. Pat. Nos. 3,784,209, 4,065,37, 4,266,772, 4,483,537, 4,683,257, 4,688,801, 4,714,253, and 4,715,607.

As described in those patents, suitable crosslinkable elastomers include homopolymers, copolymers or terpolymers of butadiene, isoprene or chloroprene. Preferably, the elastomer is 1,4 polybutadiene having a cis structure in a proportion of at least 40%. Most preferably the polybutadiene rubber contains at least 90% and even more preferably at least 95% of cis-1,4 bonds. If desired, natural rubbers, polyisoprene rubbers, styrene/butadiene rubbers, or the like may be blended with the polybutadiene rubber. Another suitable elastomer is polyoctenylene rubber having a high trans content.

The crosslinking agent can be one or more metallic salts of unsaturated fatty acids or monocarboxylic acids, particularly, zinc, calcium or magnesium salts of acrylic acid and methacrylic acid. Zinc diacrylate, zinc acrylate, and zinc methacrylate are particularly suitable.

Any of a number of known crosslinking initiators can be used. These initiators supply free radicals and include various organic peroxides such as dicumyl peroxide and n-Butyl-4, 4-bis (t-butylperoxy) valerate on calcium silicate, which is available from R. T. Vanderbilt, Inc. of Norwalk, Conn. under the trademark Varox 230XL. Suitable crosslinking agents and crosslinking initiators are described in the aforementioned patents which describe polybutadiene cores.

The balata is preferably present in a amount ranging from 25% to 99% of the total polymer content of the outer layer of the cover. The balance of the polymer

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content, namely from 75% to 1% of the total polymer content, is preferably provided by polybutadiene having a high cis-1,4 content, but other suitable crosslinkable elastomers such as natural rubber, Vestenamer, etc. can be blended with the polybutadiene as desired.

The amount of the crosslinking agent generally ranges from 20 to 50 parts by weight of the total polymer content of the outer layer, and is preferably about 35 to 45 parts by weight.

The amount of the crosslinker initiator can range from about  $\frac{1}{2}$  to  $3\frac{1}{2}$  parts by weight of the total polymer content of the outer layer, and preferably is about 2 to  $2\frac{1}{2}$  parts by weight.

Any suitable filler, for example zinc oxide, can be added to both the inner and outer layers of the cover. Zinc oxide not only acts as a filler and as a gravity adjuster but may also provide crosslinking. Other conventional ingredients may also be included, such as titanium dioxide and Ultramarine Blue.

FIG. 1 illustrates a two-piece golf ball 10 which includes a solid core 11 and a cover 12 which comprises a relatively hard inner layer 13 of one or more ionomer resins and a relatively soft outer layer 14 of polymeric material. The solid core can be formed in the conventional manner.

FIG. 2 illustrates a three-piece golf ball 16 which includes a wound core 17 which comprises a center 18 and a layer 19 of windings of elastic thread. The center may be solid or a liquid filled balloon. Such wound cores are also conventional. A cover 20 includes a relatively hard inner layer 21 of one or more ionomer resins as previously described and a relatively soft outer layer 22 of polymeric material as previously described.

The diameter of the core of either the two-piece or the three-piece ball can be within the range of about 1.000 to 1.500 inch. The thickness of the inner layer can be within the range of about 0.0250 to 0.2875 inch to provide a total diameter of the inner layer and core within the range of about 1.550 to 1.590 inch. The thickness of the outer layer can be within the range of about 0.0450 to 0.0650 inch to provide a total ball diameter of 1.680 inch. The preferred dimensions are a core diameter of 1.500 inch, an inner layer thickness of 0.037 inch (inner layer diameter of 1.575 inch), and an outer layer thickness of 0.0525 inch (total ball diameter of 1.680 inch).

#### EXAMPLE I

Two specific solid core compositions used with the new two-layer cover had the composition described in Table 1. One core was used in a golf ball which was designated as a 90 compression ball, and the other core was used in a golf ball which was designated as a 100 compression ball.

TABLE 5

Composition of Core (Parts by Weight)		
	90 Compression	100 Compression
Polybutadiene Rubber	95.00	95.00
Vestenamer 8012	5.00	5.00
Zinc Oxide	12.20	11.10
Zinc DiAcrylate	35.00	38.00
Antioxidant	0.80	0.80
Peroxide (Lupercos 101 XL)	0.80	0.80
Liquid Monomer SR-351 (TMPTA)	5.00	5.00

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TABLE 5-continued

Composition of Core (Parts by Weight)		
	90 Compression	100 Compression
Total	153.80	156.80

The antioxidant was 2,2'-Methylenebis (4-methyl-6-tertbutylphenol) which was obtained from R. T. Vanderbilt Co. of Norwalk, Conn. under the trade name Vanox MBPC.

The peroxide is an organic peroxide available from Atochem North America Inc., Philadelphia, Pa.

The Liquid Monomer is Trimethylolpropane Triacrylate available from Sartomer, Westchester, Pa.

The core was processed according to the conventional steps:

1. core rubber compound mixed
2. mill and preform slug
3. mold core
4. centerless grind core to size.

The composition of the inner layer of the cover is described in Table 6.

TABLE 6

Composition of Inner Layer of Cover (Parts by Weight)		
Ionomer Type	Blend Ratio	
Sodium-Surlin 8940	75%	
Zinc-Surlin 9910	25%	

The inner layer can be molded in one of two methods:  
1. Injection molded over the core in a manner which is conventionally used to injection mold ionomers over a solid core.

2. Injection mold halfshells, place halfshells over the core, compression mold the inner cover over the core.

After either method of molding the inner layer is completed, the surface is centerless ground to a preferred size of 1.575 inch in diameter prior to the final cover molding step.

The composition of the outer layer of the cover is described in Table 7.

TABLE 7

Composition of Outer Layer (Parts by Weight)	
Trans Polyisoprene (TP-301)	60.00
Polybutadiene	40.00
Zinc Oxide	5.00
Titanium Dioxide	17.00
Ultramarine Blue color	.50
Zinc DiAcrylate	35.00
Peroxide (Varox 230 XL)	2.50
Total	160.00

Ultramarine Blue is a blue toner which is used to enhance the white color of the cover and is available from Whittaker, Clark & Daniels, Inc. of South Plainfield, N.J.

The outer layer of the cover was made by conventional mixing and molding procedures. The components of the composition are mixed on a mill such as a two roll mill to form slabs. Slabs are fed into a dicer which cubes the cover compound prior to the injection molding to form generally hemispherical halfshells. The halfshells are placed about the inner layer of the ball in a compression molding machine which fuses the halfshells to each

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other and to the inner layer. The compression molding operation is carried out under a temperature of about 250° to 350° F. for about 5 to 10 minutes. The molding temperature causes the elastomer to crosslink, and it is believed that the ball is fully crosslinked when it is removed from the compression mold.

The outer layer composition can also be used in a conventional injection molding machine to form an injection molded outer layer about the inner layer.

The rheology chart of FIG. 3 shows that the crosslinking agent causes crosslinking of not only the polybutadiene but also of the balata and that the composition is fully crosslinked after the molding operation. The rheology chart was prepared by tests conducted on a Monsanto Moving Die Rheometer MDR 2000 available from Monsanto Instruments & Equipment of Akron, Ohio. The rheometer is used to measure cure characteristics of rubber and measures the reaction torque as a function of cure time or degree of vulcanization. Curing was performed at 300° F.

FIG. 3 compares the following outer layer compositions.

EXG24-60: from Table 8

EXG24-71: same as EXG24-60 but without polybutadiene (100% TP301)

EXG24-58: same as EXG24-60 but without polybutadiene and peroxide

TABLE 8

	EXG24-60
Trans-Polyisoprene TP-301	84.00
Polybutadiene	16.00
ZnO	13.00
ZDA	35.00
TiO <sub>2</sub>	17.00
Ultramarine Blue	.50
Peroxide (Varox 230XL)	2.50
Total	168.00

EXG24-58 without peroxide exhibits very poor curing characteristics. The other two formulas have comparable curves, which indicate that the composition which includes balata and polybutadiene is just as crosslinkable as the composition which contains only balata and no polybutadiene.

FIG. 4 is a rheology chart which compares the three outer layer compositions set forth in Table 9:

TABLE 9

	EXG24-78	EXG24-77	EXG24-76
Trans Polyisoprene	84.00	84.00	84.00
Natural Rubber	16.00	16.00	16.00
ZnO	13.00	13.00	13.00
TiO <sub>2</sub>	17.00	17.00	17.00
Ultramarine Blue	.20	.20	.20
Stearic Acid	.26	.26	.26
Thiozole Accelerator	.26	.26	.26
Sulfur	1.20	1.20	—
RR-2 Crystals	1.50	—	—
Total	133.42	131.92	130.72

Formula EXG24-78 is comparable to a conventional prior art balata cover which is cured by sulfur and the step of soaking the completed ball in an alcohol/RR2 crystal solution described in Step No. 15 of Table 1. However, in order to test the composition on the MDR 2000 Rheometer the RR2 crystals were incorporated into the composition to simulate the subsequent soaking step.

Formula EXG24-77 is the same as formula EXG24-78 but omits the RR2 crystals. Formula EXG24-76 is

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the same as formula EXG24-78 but omits both sulfur and the RR2 crystals.

It is significant to note the difference between the cure rheology of the balata compositions illustrated in FIG. 4 and the new balata compositions cured by zinc diacrylate and peroxide illustrated in FIG. 3. The rheology physical properties for the compositions in FIG. 4 are so low compared to the compositions of FIG. 3 that the scale of FIG. 4 had to be changed from 0 to 100 torque units to 0 to 5 torque units in order to be meaningful. The cover composition of formula EXG24-60 of FIG. 3 has significantly higher torque than formula EXG24-78 of FIG. 4. Also, the rheology cure curve for formula EXG24-78 shows reversion, while the cure curve of formula EXG24-60 shows essentially a curve which is flatlined.

Because the balata-containing outer layer of the cover in accordance with the invention is fully crosslinked after the molding operation, the golf balls can be processed in a manner in which is very similar to the processing of Surlyn covered balls, thereby greatly facilitating the additional processing steps and reducing the overall cost of the balls. The processing steps for 3 piece and 2 piece balls formed in accordance with the invention are described in Tables 10 and 11, and these processing steps can be compared with the steps described in Tables 1-3.

TABLE 10

## New 3 Piece Process

- 1 center rubber compound mixed
2. mill and preform slug
3. mold center
4. center flash removed
5. wind center with heat resistant thread
6. injection mold halfshells for the inner layer of the cover
7. place the halfshells of the inner layer over the core
8. compression mold the halfshells of the inner layer over the core
9. grind inner cover surface to size if required
10. injection mold the halfshells of the outer layer
11. place the halfshells of the outer layer over the molded inner layer
12. compression mold ball
13. seam buff parting line
14. vibratory finish ball
15. apply primer
16. logo print
17. apply clear top coat
18. inspect and package

TABLE 11

## New 2 Piece Process

1. core rubber compound mixed
2. mill and preform slug
3. mold core
4. centerless grind core to size
5. injection mold Surlyn inner layer of the cover around core or injection mold halfshells for the inner cover layer then compression mold halfshells around core
6. grind inner cover surface to size if required
7. injection mold halfshells of the outer layer of the cover
8. place halfshells of the outer layer over the molded inner layer

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9. compression mold the halfshells of the outer layer over the inner layer
10. seam buff parting line
11. vibratory finish ball
12. apply primer
13. logo print
14. apply clear coat
15. audit inspect and package

Note: The outer layer of the cover can also be injection molded over the inner layer using conventional injection molding technology.

Steps 5 and 10 through 25 in Table 1 have been eliminated using the new technology described in Tables 10 and 11. The 30 steps used to process balata covers in the old procedure have been replaced by 18 steps for 3 piece balls and 15 steps for 2 piece balls.

Balls formed in accordance with Example 1 (100 compression) were flight tested with an automatic hitting machine using a driver, a 5 iron, and a pitching wedge. The inventive balls were compared with Titleist Tour 100 balata balls, which is a popular balata covered 3 piece ball. The comparative flight test data is found in Table 12.

TABLE 12

	Carry	Difference	Total	Difference
<b>HARD DRIVER- 7 Degree Launch Angle</b>				
Titleist Tour 100 Balata	251.0	Base	268.7	Base
Example 1 ball	252.3	+1.3	272.2	+3.5
<b>HARD DRIVER- 9 Degree Launch Angle</b>				
Titleist Tour 100 Balata	250.5	Base	258.7	Base
Example 1 ball	254.0	+3.5	263.7	+7.6
<b>HARD DRIVER- 11 Degree Launch Angle</b>				
Titleist Tour 100 Balata	249.6	Base	255.0	Base
Example 1 ball	255.0	+5.3	262.6	+7.6
<b>FIVE IRON</b>				
Titleist Tour 100 Balata	166.6	Base	183.8	Base
Example 1 ball	167.1	+0.5	182.0	-1.8
<b>PITCHING WEDGE</b>				
Titleist Tour 100 Balata	102.6	Base	107.9	Base
Example 1 ball	103.0	+0.4	106.8	-1.1

The comparative flight test data inventive ball is measurably longer than the Titleist Tour 100 ball off the hard driver at 7, 9, and 11 launch angles. Also, the inventive ball has parity holding with five iron and wedge shots.

Balls formed in accordance with Example 1 (100 compression) were subjected to the standard cut resistance test of Wilson Sporting Goods Co. The cut resistance test is conducted using a True Temper Driving Machine. The test club used is a pitching wedge. Six (6) balls of each type are tested and hit one time each approximately  $\frac{1}{4}$  inch above the centerline of the ball (random orientation) at standard clubhead velocities. The golf balls are inspected and graded as follows:

FACTOR	DESCRIPTION
10	No visible mark
9	Must search to find mark
8	Visible dent
7	Feel with fingernail- no cut
6	Fingernail inserts- cut
5	Fingernail inserts to core- core not visible
4	Core visible- core not cut
3	Core just cut
2	Core cut deep
1	Core destroyed

The factors of the six (6) golf balls of each type are averaged to obtain an overall factor. The golf balls are

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evaluated by relative comparison with other golf balls of known cut resistance.

The inventive balls formed in accordance with Example 1 were compared to Titleist Tour 100 balata, Spalding Tour Edition 100 (Soft Ionomer cover), and Ultra (Hard Surlyn cover), the comparative cut resistance data is found in Table 13.

TABLE 13

Ball I.D.	Cut Resistance Factor
Titleist Tour 100 balata	4.8
Spalding Tour Edition 100	6.2
Ultra	7.3
Example 1 ball	7.0

The data presented illustrates that the inventive ball is dramatically improved for cut resistance over the Titleist Tour 100 balata ball, marginally better than the Tour Edition ball, and nearly parity to the hard Surlyn Ultra ball.

While in the foregoing specification a detailed description of specific embodiments of the invention were set forth for the purpose of illustration, it will be under-

stood that many of the details herein given may be varied considerably by those skilled in the art without departing from the spirit and scope of the invention.

I claim:

1. A golf ball comprising a core and a cover, the cover comprising an inner layer molded over the core and an outer layer molded over the inner layer, the inner layer comprising ionomer resin and the outer layer containing natural or synthetic balata as a principal ingredient.

2. The golf ball of claim 1 in which the outer layer includes a blend of natural or synthetic balata and polybutadiene.

3. The golf ball of claim 1 in which the outer layer includes natural or synthetic balata in an amount ranging from 25 to 99% of the total weight of polymer of the outer layer and a crosslinkable elastomer in an amount ranging from 1 to 75% of the total weight of polymer of the outer layer, said elastomer being selected from the group consisting of polyoctenylene; homopolymers, copolymers, or terpolymers of butadiene; and homopolymers, copolymers, or terpolymers of chloroprene.

4. The golf ball of claim 1 in which the diameter of the core is within the range of about 1.000 to 1.500 inch, the thickness of the inner layer is within the range of about 0.0250 to 0.2875 inch, the thickness of the outer

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layer is within the range of about 0.0450 to 0.650 inch, and the diameter of the golf ball is at least 1.680 inches.

5. The golf ball of claim 1 in which the diameter of the core is about 1.500 inch, the thickness of the inner layer is about 0.0375 inch, the thickness of the outer layer is about 0.0525 inch, and the diameter of the golf ball is 1.680 inches.

6. A golf ball comprising a core and a cover, the cover comprising an inner layer of ionomer resin molded over the core and an outer layer molded over the inner layer, the outer layer being formed from a composition comprising:

- a) natural or synthetic balata;
- b) an elastomer which is crosslinkable with a metallic salt of an unsaturated fatty acid, said elastomer being selected from the group consisting of polyoctenylene; homopolymers, copolymers, or terpolymers of butadiene; and homopolymers, copolymers or terpolymers of chloroprene;
- c) a metallic salt of an unsaturated fatty acid as a crosslinking agent; and
- d) a crosslinking initiator which provides a source of free radicals.

7. The golf ball of claim 6 in which the elastomer of the outer layer is selected from the group consisting of polybutadiene and polyoctenylene.

8. The golf ball of claim 6 in which the natural or synthetic balata of the outer layer is present in an amount ranging from 25 to 99% of the total weight of polymer of the outer layer and the crosslinkable elastomer is present in an amount ranging from 1 to 75% of the total rate of polymer of the outer layer.

9. The golf ball of claim 6 in which the crosslinking agent of the outer layer is selected from the group of zinc salts, calcium salts, and magnesium salts of monocarboxylic acids.

10. The golf ball of claim 6 in which the crosslinking initiator of the outer layer is organic peroxide.

11. The golf ball of claim 6 in which the core is a solid core.

12. The golf ball of claim 7 in which the core is a 2 piece core comprising a center and a layer of elastic windings over the center.

13. The golf ball of claim 6 in which the crosslinkable elastomer of the outer layer is polybutadiene.

14. The golf ball of claim 13 in which the polybutadiene is cis 1,4 polybutadiene having a cis content of at least 40%.

15. The golf ball of claim 6 in which the diameter of the core is within the range of about 1.000 to 1.500 inch, the thickness of the inner layer is within the range of about 0.0250 to 0.2875 inch, the thickness of the outer layer is within the range of about 0.0450 to 0.650 inch, and the diameter of the golf ball is at least 1.680 inches.

16. The golf ball of claim 6 in which the diameter of the core is about 1.500 inch, the thickness of the inner layer is about 0.0375 inch, the thickness of the outer layer is about 0.0525 inch, and the diameter of the golf ball is 1.680 inches.

17. A golf ball comprising a core and a cover, the cover comprising an inner layer of ionomer resin molded over the core and an outer layer molded over

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the inner layer, the outer layer being formed from a composition comprising:

- a) from 25 to 99 parts by weight of natural or synthetic balata;
- b) from 1 to 75 parts by weight of an elastomer which is crosslinkable with a metallic salt of an unsaturated fatty acid, said elastomer being selected from the group consisting of polyoctenylene, homopolymers, copolymers, or terpolymers of butadiene; and homopolymers, copolymers, or terpolymers of chloroprene;
- c) from 20 to 50 parts by weight of a metallic salt of an unsaturated fatty acid as a crosslinking agent; and
- d) from  $\frac{1}{4}$  to  $\frac{3}{4}$  parts by weight of a crosslinking initiator which provides a source of free radicals.

18. The golf ball of claim 17 in which the crosslinkable elastomer of the outer layer, is polybutadiene.

19. The golf ball of claim 18 in which the polybutadiene is cis 1,4 polybutadiene having a cis content of at least 40%.

20. The golf ball of claim 17 in which the diameter of the core is within the range of about 1.000 to 1.500 inch, the thickness of the inner layer is within the range of about 0.0250 to 0.2875 inch, the thickness of the outer layer is within the range of about 0.0450 to 0.650 inch, and the diameter of the golf ball is at least 1.680 inches.

21. The golf ball of claim 17 in which the diameter of the core is about 1.500 inch, the thickness of the inner layer is about 0.0375 inch, the thickness of the outer layer is about 0.0525 inch, and the diameter of the golf ball is 1.680 inches.

22. A method of making a golf ball comprising the steps of:

- a) forming a spherical core;
- b) molding ionomer resin over the core to form a first cover layer;
- c) forming a blended composition of balata, crosslinkable elastomer, a metallic salt of an unsaturated fatty acid as a crosslinking agent, and a crosslinking initiator which provides a source of free radicals, said crosslinkable elastomer being selected from the group consisting of polyoctenylene, homopolymers, copolymers, or terpolymers of butadiene; and homopolymers, copolymers, and terpolymers of chloroprene; and
- d) molding said blended composition over the first cover layer to form a second cover layer and to crosslink the crosslinkable elastomer.

23. The golf ball obtained by the method of claim 22 in which the molding of the blended composition is performed under a temperature of about 250° to 350° F. for about 5 to 10 minutes.

24. The golf ball obtained by the method of claim 22 in which the diameter of the core is within the range of about 1.000 to 1.500 inch, the first cover layer is molded to a thickness within the range of about 0.0250 to 0.2875 inch, and the second cover layer is molded to a thickness within the range of about 0.0450 to 0.650 inch.

25. The golf ball of claim 24 in which the diameter of the core is about 1.500 inch, the first cover layer is molded to a thickness of about 0.0375 inch, and the second cover layer is molded to a thickness of about 0.0525 inch.

\* \* \* \* \*

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<b>Interview Summary</b>	Application No. 08/870,585	Applicant(s) Sullivan	
	Examiner Mark S. Graham	Group Art Unit 3711	

All participants (applicant, applicant's representative, PTO personnel):

(1) Mark S. Graham (3) \_\_\_\_\_

(2) Brian Bembenick (4) \_\_\_\_\_

Date of Interview Apr 9, 1999

Type: ☐ Telephonic ☒ Personal (copy is given to ☐ applicant ☒ applicant's representative).

Exhibit shown or demonstration conducted: ☐ Yes ☒ No. If yes, brief description:  
\_\_\_\_\_  
\_\_\_\_\_

Agreement ☐ was reached. ☒ was not reached.

Claim(s) discussed: all generally

Identification of prior art discussed:  
Proudfit

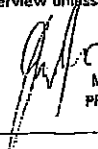
Description of the general nature of what was agreed to if an agreement was reached, or any other comments:  
Applicant to file 131 affidavit swearing behind Proudfit reference. While the examiner pointed out that such would not be timely it was decided that if the examiner found the affidavit persuasive with regard to the co-pending 08/926,246 application (not under final) it would also be entered in the instant application.

(A fuller description, if necessary, and a copy of the amendments, if available, which the examiner agreed would render the claims allowable must be attached. Also, where no copy of the amendments which would render the claims allowable is available, a summary thereof must be attached.)

1 ☒ It is not necessary for applicant to provide a separate record of the substance of the interview.

Unless the paragraph above has been checked to indicate to the contrary, A FORMAL WRITTEN RESPONSE TO THE LAST OFFICE ACTION IS NOT WAIVED AND MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a response to the last Office action has already been filed, APPLICANT IS GIVEN ONE MONTH FROM THIS INTERVIEW DATE TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW.

2. Since the Examiner's Interview summary above (including any attachments) reflects a complete response to each of the objections, rejections and requirements that may be present in the last Office action, and since the claims are now allowable, this completed form is considered to fulfill the response requirements of the last Office action. Applicant is not relieved from providing a separate record of the interview unless box 1 above is also checked.

  
 MARK S. GRAHAM  
 PRIMARY EXAMINER  
 ART UNIT 3711

Examiner Note: You must sign and stamp this form unless it is an attachment to a signed Office action.

# **EXHIBIT 38**

IN THE UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF DELAWARE

CALLAWAY GOLF COMPANY )

Plaintiff, )

v. )

ACUSHNET COMPANY, )

Defendant. )

C. A. No. 06-91 (SLR)

DECLARATION OF JEFFREY L. DALTON IN SUPPORT OF ACUSHNET'S  
MOTION FOR SUMMARY JUDGMENT OF INVALIDITY  
OF U.S. PATENT NOS. 6,210,293; 6,506,130; 6,503,156; AND 6,595,873

I, Jeffrey L. Dalton, hereby state as follows:

- 1) I am employed at the Acushnet Company ("Acushnet"), located at 333 Bridge Street, Fairhaven, Massachusetts 02719.
- 2) My current job title is Vice President of Intellectual Property.
- 3) I personally directed and witnessed the creation of golf ball materials and golf balls at the direction of Dr. William MacKnight, who has been retained by Acushnet in the above-captioned litigation.
- 4) I met with Dr. MacKnight in early May 2007 to discuss the preparation of golf balls materials and golf balls. Troy Lester, Acushnet's Chief Patent Counsel, was also present during that meeting. During that meeting, Dr. MacKnight and I discussed which materials and golf balls to make, and by the conclusion of the meeting, Dr. MacKnight had instructed me to make certain materials and certain golf balls with various combinations of core formulations and diameter, inner cover layer formulations and thicknesses, and outer cover formulations and thicknesses.

5) Specifically, Dr. MacKnight instructed me to make twelve (12) samples each of twelve (12) different constructions of golf balls. The first 9 golf ball constructions that I was instructed to make are accurately set forth in Dr. MacKnight's declaration, and are identified as BALL\_1, BALL\_2, BALL\_3, BALL\_4, BALL\_5, BALL\_6, BALL\_7, BALL\_8, and BALL\_9. MacKnight Decl. ¶¶ 17-25. Dr. MacKnight's declaration is attached to his Expert Report, which is attached hereto as Exhibit A. Dr. MacKnight also instructed me to make twelve (12) samples of BALL\_4, BALL\_5, and BALL\_6, but without the Blowing Agent Master Batch B in the inner cover layer.

6) Dr. MacKnight also directed me to create seven "plaques" of cover layer materials. Six of those materials are accurately described by Dr. MacKnight in his declaration as ICL\_1, ICL\_2, ICL\_3, OCL\_1, OCL\_2, and OCL\_3. MacKnight Decl. ¶¶ 10-15. The seventh material was the blend described in Dr. MacKnight's report as ICL\_2, but without the Blowing Agent Master Batch B. MacKnight Decl. ¶ 11.

7) During the meeting with Dr. MacKnight, I showed Dr. MacKnight the manufacturing equipment that would be used to create the materials and golf balls he directed, and discussed the procedures that would be used to create those materials and golf balls. Dr. MacKnight approved the process and equipment that I told him I would use.

8) Subsequent to my meeting with Dr. MacKnight, I personally directed and witnessed the creation of the balls that Dr. MacKnight had directed me to make. In particular, I created twelve (12) samples each of the nine (9) different constructions that he sets forth in his declaration as BALL\_1 through BALL\_9. MacKnight Decl. ¶¶ 17-25. I also created twelve (12) samples each of BALL\_4, BALL\_5, and BALL\_6, but without the Blowing Agent Master Batch B in the inner cover layer. I also personally directed the placement of a dimple pattern on each ball and the painting and finishing of each ball. I also personally directed and witnessed the creation of the plaques of cover layer material that I describe in paragraph 6 above. I personally inspected the balls and materials during and after their creation to ensure that they had the compositions that are described in Dr. MacKnight's expert report.

9) I have read and understand Dr. MacKnight's description of the balls that I made, and Dr. MacKnight's description accurately describes the balls that I made. MacKnight Dec. ¶¶ 7-26. If called to testify at trial I would testify that the balls that I created have the material compositions and properties that are set forth in Dr. MacKnight's expert report.

10) On or about May 17, 2007, I brought the material plaques and balls that I had made to the Plastics Testing Lab, Inc. ("PTLI") facility in Pittsfield, Massachusetts, which I understand is an accredited tester for Shore D hardness. I also brought samples of Wilson Ultra Tour Balata 90 and Wilson Ultra Tour Balata 100 balls from Acushnet's archives. Mr. Lester accompanied me. There, I met with Dr. MacKnight and James Galipeau, the Laboratory Manager.

11) Dr. MacKnight explained to Mr. Galipeau what tests to be performed on the golf balls we brought to PTLI. Specifically, he explained that he wanted to have the lab perform Shore D hardness measurements on the surface of the formed golf balls. Dr. MacKnight explained that he wanted the tests to be performed in accordance with ASTM D-2240, with the exception that the tests would be performed on the surface of the golf ball rather than on a plaque of material as required by ASTM D-2240.

12) Dr. MacKnight also directed Mr. Galipeau to perform the following measurements on the material plaques that were provided to him: a) flexural modulus tests according to ASTM D-790; b) Shore D tests according to ASTM D-2240; and c) measurements of the thickness of the plaques of materials.


13) Mr. Galipeau showed Dr. MacKnight and me the test equipment that was to be used for the tests, and Dr. MacKnight approved the procedures and equipment that were to be used for the measurements.

14) I have read and understand Dr. MacKnight's description of the testing that PTLI was instructed to perform, and Dr. MacKnight's description accurately describes what was communicated to PTLI. MacKnight Dec. ¶¶ 27-31.

15) On May 23, 2007, Mr. Galipeau emailed the results of PTLI's testing to Mr. Lester, who forwarded the email to me. A true and correct copy of the testing report that was sent by PTLI is attached hereto as Exhibit B.

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I declare, under penalty of perjury, that the foregoing is true and correct. I would testify to the foregoing facts if called to do so in Court.

  
Jeffrey L. Dalton

Executed on: August 24, 2007

# Exhibit A

## To Dalton Declaration

IN THE UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF DELAWARE

CALLAWAY GOLF COMPANY,

Plaintiff,

v.

ACUSHNET COMPANY,

Defendant.

C.A. No. 06-91 (SLR)

**EXPERT REPORT OF DR. WILLIAM J. MACKNIGHT**

1. My name is William J. MacKnight. I submit this report to describe testing I have performed related to invalidity arguments that have been made by Acushnet with respect to U.S. Patent Nos. 6,210,293 ("the '293 patent"), 6,503,156 ("the '156 patent"), 6,506,130 ("the '130 patent"), and 6,595,873 ("the '873 patent") (collectively the "Sullivan patents"). I have personal knowledge of the matters discussed herein, and I would testify to them under oath if called upon to do so.

2. I hold the position of Wilmer D. Barrett Distinguished Professor (Emeritus) in the Polymer Science and Engineering Department at the University of Massachusetts. I have been a professor at the University of Massachusetts since 1965, and was named Wilmer D. Barrett Distinguished Professor in 1998.

3. My educational background is summarized as follows:

1958: B.S. in Chemistry (with Distinction), University of Rochester

1963: M.A. in Chemistry, Princeton University

1964: Ph.D. in Physical Chemistry, Princeton University

1964: NSF Cooperative Fellow, Princeton University

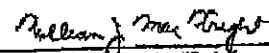
4. I consider myself an expert in the field of polymer science, based on my years of teaching and research in that area. My resume is attached to this report as Exhibit A.

5. I understand Acushnet has presented arguments regarding the patentability of the Sullivan Patents in relation to several prior art references, including U.S. Patent No. 4,431,193 to Nesbitt ("Nesbitt 193"), U.S. Patent No. 5,314,187 to Prondfit ("Prondfit 187"), U.S. Patent No. 4,274,637 to Molitor ("Molitor 637"), U.S. Patent No. 5,334,673 to Wu ("Wu 673"), and U.S. Patent No. 4,674,751 to Molitor ("Molitor 751").

6. I was asked by Acushnet and its lawyers to direct the preparation and testing of certain golf balls that are described by the patents listed above, or combinations thereof. I personally directed the preparation and testing of such golf balls.

7. The methods by which I prepared and tested the golf balls, and the results of those tests, are set forth in detail in the declaration I submitted to the Patent Office, which is attached to this report as Exhibit B. If asked to do so, I will testify at trial regarding the testing I performed.

Respectfully,

  
Dr. William J. MacKnight

Dated: June 1, 2007

# EXHIBIT A

*WILLIAM J. MACKNIGHT*

Wilmer D. Barrett Distinguished Professor Emeritus  
Polymer Science and Engineering Department

Education

1954-58 B.S. in Chemistry (with Distinction), University of Rochester  
1961-64 Princeton University, M.A. in Chemistry, 1963  
Ph.D. in Physical Chemistry, 1964  
NSF Cooperative Fellow, 1964

Post Doctoral

1964-65 Research Associate in Chemistry, Princeton University (with A.V. Tobolsky)

Military Service

1958-61 U.S. Navy. Initial rank, Ensign; final rank, Lieutenant

Employment

1965- University of Massachusetts  
1965-69 Assistant Professor of Chemistry  
1969-74 Associate Professor of Chemistry  
1974-76 Professor of Chemistry  
1976-85 Professor and Head, Polymer Science and Engineering  
1985-88 Professor, Polymer Science and Engineering  
1988-95 Professor and Head, Polymer Science and Engineering  
1995-96 Professor, Polymer Science and Engineering  
1996-98 Distinguished University Professor, Polymer Science and Engineering  
1998-1999 Wilmer D. Barrett Distinguished Professor  
1999- Wilmer D. Barrett Distinguished Professor Emeritus

Some Recent Activities

Visiting Professor, Department of Chemical Engineering and Chemical Technology, Imperial College, London, England, 1979 and 1996  
Member, Editorial Board, Macromolecules, 1981-84  
Member, Evaluation Panel for the Center for Material Science, National Bureau of Standards, 1982-88  
Member, National Academy of Sciences, National Research Council Board of the Conference on Insulation and Dielectric Phenomena, 1981-84  
Chairman of the Gordon Conference on Polymers (West), 1982  
Chairman of the Gordon Conference on Dielectric Phenomena, 1982  
Chairman of the Gordon Conference on Ion-Containing Polymers, 1985  
Member Research Briefing Panel on Polymeric Structural Materials of the National Research Council, 1984  
Member, Science and Technology Advisory Council, Alcoa, 1984-86  
Member, Board of Trustees, Plastics Institute of America, 1984-87  
Member, Governing Board, Council of Chemical Research, 1982-85

Member, Technical Advisory Board, Diversitech General, 1984-87  
Member, Council of the Gordon Research Conferences, 1984-1988  
Member, Editorial Board, Polymers for Advanced Technologies, 1988-  
Member, Editorial Board, Acta Polymerica, 1992-  
Member, Editorial Board, Gels and Networks, 1992-1998

#### Membership

American Chemical Society  
American Physical Society (Fellow)  
American Association for the Advancement of Science (Fellow)  
National Academy of Engineering

#### Honors and Awards

Ford Prize in High Polymer Physics administered by the Division of High Polymer Physics of the American Physical Society, 1984 (joint with F.E. Karasz)  
UMass. Faculty Fellowship Award for excellence in research 1984-85  
John Simon Guggenheim Memorial Foundation Fellow, 1985-86  
American Chemical Society Award in Polymer Chemistry (Mobil Award), 1997  
Distinguished Service Award in Advancement of Polymer Science administered by The Society of Polymer Science, Japan, 1998  
Herman F. Mark Award administered by the Division of Polymer Chemistry of the American Chemical Society, 2002  
Fellow, Polymer Materials Science & Engineering Division, American Chemical Society, 2004

#### Publications

About 340 publications and 8 patents in the field of structure-property relationships in microphase separated polymers including ionomers, polyblends and polyurethanes.

Co-Author of two books:

Polymeric Sulfur and Related Polymers, 1965 (with A.V. Tobolsky)  
Introduction to Polymer Viscoelasticity, 1<sup>st</sup> Edition, 1975 (J.J. Aklonis and M.C. Shen), 2<sup>nd</sup> Edition, 1983 (with J.J. Aklonis), 3<sup>rd</sup> Edition, 2005 (with M.T. Shaw)

3/21/06

# EXHIBIT B

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Sullivan )  
Reexamination Proceeding )  
Control No.: 95/000,120 ) Examiner: Michael W. O'Neill  
Filed: January 17, 2006 ) Art Unit: 3993  
For: U.S. Patent No. 6,210,293 )

In re Sullivan )  
Reexamination Proceeding )  
Control No.: 95/000,121 ) Examiner: Michael W. O'Neill  
Filed: January 17, 2006 ) Art Unit: 3993  
For: U.S. Patent No. 6,503,156 )

In re Sullivan )  
Reexamination Proceeding )  
Control No.: 95/000,122 ) Examiner: Michael W. O'Neill  
Filed: January 17, 2006 ) Art Unit: 3993  
For: U.S. Patent No. 6,506,130 )

In re Sullivan )  
Reexamination Proceeding )  
Control No.: 95/000,123 ) Examiner: Michael W. O'Neill  
Filed: January 17, 2006 ) Art Unit: 3993  
For: U.S. Patent No. 6,595,873 )

Central Reexamination Unit  
571-273-9900

DECLARATION OF WILLIAM J MACKNIGHT UNDER 37 C.F.R. §1.132

I, William J. MacKnight, state as follows:

1. I have been asked by third party requestor Acushnet to provide a declaration in connection with its Third Party Comments after Patent Owner Response to the USPTO Office actions regarding U.S. Patent Nos. 6,210,293 ("the '293 patent"), 6,503,156 ("the '156 patent"), 6,506,130 ("the '130 patent"), and 6,595,873 ("the '873 patent") (collectively the "Sullivan patents"). I have personal knowledge of the matters discussed herein, and I would testify to them under oath if called upon to do so.

2. I hold the position of Wilmer D. Barrett Distinguished Professor (Emeritus) in the Polymer Science and Engineering Department at the University of Massachusetts. I have been a professor at the University of Massachusetts since 1965, and was named Wilmer D. Barrett Distinguished Professor in 1998.

3. My educational background is summarized as follows:

1958: B.S. in Chemistry (with Distinction), University of Rochester

1963: M.A. in Chemistry, Princeton University

1964: Ph.D. in Physical Chemistry, Princeton University

1964: NSF Cooperative Fellow, Princeton University

4. I consider myself an expert in the field of polymer science, based on my years of teaching and research in that area.

5. I understand Acushnet has presented arguments to the USPTO regarding the patentability of the Sullivan Patents in relation to several prior art references, including U.S. Patent No. 4,431,193 to Nesbitt ("Nesbitt 193"), U.S. Patent No. 5,314,187 to Proudfit ("Proudfit 187"), U.S. Patent No. 4,274,637 to Molitor ("Molitor 637"), U.S. Patent No. 5,334,673 to Wu ("Wu 673"), and U.S. Patent No. 4,674,751 to Molitor ("Molitor 751").

6. I was asked by Acushnet and its lawyers to direct the preparation and testing of certain golf balls that are described by the patents listed above, or combinations thereof. I have personally directed the preparation and testing of the materials and golf balls described herein.

#### PREPARATION OF GOLF BALLS

7. At my direction, technical personnel at Acushnet's Research and Development department created several golf balls to be tested for Shore D hardness of the outer cover layer, as measured on the surface of the ball. In particular, I directed the preparation of twelve (12) samples each of nine (9) constructions of golf balls with various combinations of core formulation and diameter, inner cover layer formulation and thickness, and outer cover layer formulation and thickness.

PREPARATION OF MATERIALS TO BE USED IN THE GOLF BALLS

8. I directed the preparation of two types of golf ball core materials. The first golf ball core material is based on the disclosure of Nesbitt 193. In particular, the core material has the following composition:

Material	Weight
Polybutadiene (BR-1220)	70.70
Polybutadiene (Taktene 220)	29.30
Zinc Diacrylate	31.14
Zinc Oxide	6.23
Zinc Stearate	20.15
Limestone	17.58
Ground Flash	20.15
Blue Masterbatch	0.012
Lupercio 231 XL	0.89

This composition is based on the core composition set forth in the Sullivan patents, for example, '293 patent, col. 16:15-30. I based this core composition on that set forth in the Sullivan patents to represent the Nesbitt 193 core for two reasons. First, Nesbitt 193 does not set forth any core composition. Second, the Sullivan patents describe balls using this core composition as "representative of the [Nesbitt] '193 patent" and as "the prior art ball of the [Nesbitt] '193 patent." See, for example, '293 patent, col. 18:33-35; col. 19:6-8. The only difference between the core composition set forth above and that set forth in the Sullivan patents as representing the Nesbitt 193 core is that the composition above does not include Papi 94, while the Sullivan patents describe using a small (0.50 by weight) amount of Papi 94 in its description of the core composition. See, for example, '293 patent, col. 16:28. I decided not to use any Papi 94 in the composition of this core because of the difficulty of obtaining the

substance and the fact that it is a dangerous substance to work with. In my opinion, based on my experience, the absence of 0.50 by weight of Papi 94 in the core composition would have negligible or no effect on any measurements of hardness of the outer cover layer of a formed ball using that core composition. I will refer to this core material herein as CORE\_1.

9. The second golf ball core material that was prepared at my direction is based on the disclosure of Proudfit 187. In particular, the core has the following composition:

Material	Weight
Polybutadiene (Taktene 220)	95.00
Vestenamer 8012	5.00
Zinc Oxide	12.20
Zinc Diacrylate	35.00
Antioxidant	0.80
Peroxide (Luperc 101 XL)	0.080
Liquid Monomer SR-351	5.00

This composition is set forth in Table 5 of Proudfit 187, col. 7: 56-68. I will refer to this core material herein as CORE\_2.

10. I directed the preparation of three inner cover layer materials. The first inner cover layer material is based on the disclosure of Nesbitt 193. In particular, the inner cover layer material is Surlyn 8940 (formerly Surlyn 1605), which is described in Nesbitt 193, col. 3:26-30. I will refer to this inner cover layer material herein as ICL\_1.

11. The second type of inner cover layer material that was prepared at my direction is based on the disclosure of Molitor 637. In particular, the inner cover layer material has the following composition:

Material	Parts
Surlyn 1605 (now 8940)	88.00
Surlyn 1557 (now 9650)	17.40
TiO2 Master Batch A	35.20
Blowing Agent Master Batch B	2.32

This composition is described in Molitor 637 in Table 2, col. 14:60-65. I will refer to this inner cover layer material herein as ICL\_2.

12. The third type of inner cover layer material that was prepared at my direction is based on the disclosure of Proudfit 187. In particular, the inner cover layer material has the following composition:

Material	Blend Ratio
Surlyn 8940	75%
Surlyn 9910	25%

This composition is described in Proudfit 187 in Table 6, col. 8:25-30. I will refer to this inner cover layer material herein as ICL\_3.

13. I directed the preparation of three outer cover layer materials. The first outer cover layer material is based on the disclosure of Molitor 637. In particular, the outer cover layer material has the following composition:

Material	Parts
Estane 58133	99.7
Ficel EPA	0.3

This composition is described in Molitor 637 in Table 10, col. 18:36-41. I will refer to this outer cover layer material herein as OCL\_1.

14. The second outer cover layer material that was prepared at my direction is based on the disclosure of Wu 673. In particular, the outer cover layer material has the following composition:

Material	Grams
MDI prepolymer	100.00
Polamine 250	48.87
White dispersion	5.21

This composition is described in Wu 673 in Table I, col. 7:15-23. I will refer to this outer cover layer material herein as OCL<sub>2</sub>.

15. The third outer cover layer material that was prepared at my direction is based on Molitor 751. In particular, the outer cover layer material has the following composition:

Material	Parts
Texin 480 AR (now 285)	90
Surlyn 1605 (now 8940)	10
TiO <sub>2</sub>	5
Fluorescent Brightener	0.10
Antioxidant	0.17
Pigment	0.02
Release Agent	1

This composition is based on Example 4 in the Table in Molitor 751, Col. 7-8:1-24. The only difference between this cover layer composition and that disclosed as Example 4 in Molitor 751 is that Example 4 used 10 parts of Surlyn 1702 (which is now designated 9970) rather than 10 parts of Surlyn 1605 (now 8940). Surlyn 1702 (now 9970) is disclosed in Molitor 751 as

having a Shore D hardness of 62, whereas Surlyn 1605 (now 8940) is disclosed in Molitor 751 as having a Shore D hardness of 65. These Shore D hardness properties are consistent with those set forth in the Dupont data sheet for its Surlyn resins. Accordingly, in my opinion, any hardness measurements of the material disclosed in Example 4 of Molitor 751 would be even softer (i.e. lower on the Shore D scale) than such measurements of the cover layer material that was prepared at my direction. I will refer to this outer cover layer material herein as OCL\_3.

#### PREPARATION OF GOLF BALLS

16. At my direction, Acushnet personnel made golf balls using the materials described above. I directed Acushnet personnel to make nine (9) constructions of golf balls, and for each type of golf ball construction, twelve (12) sample balls were made.

17. The first golf ball construction used the Nesbitt 193 core material (CORE\_1), the Nesbitt 193 inner cover layer material (ICL\_1), and the Molitor 637 outer cover layer material (OCL\_1). I directed Acushnet personnel to make the ball with a core diameter of 1.495 inches, an inner cover layer thickness of 0.035 inches, and an outer cover layer of 0.0575 inches. This is consistent with the description in Nesbitt 193. Specifically, Nesbitt 193 describes a core and inner cover layer whose total diameter is about 1.565 inches (which is consistent with a core whose diameter is 1.495 inches and an inner cover layer whose thickness is 0.035 inches). Nesbitt 193, col. 3:26-30. Nesbitt 193 also describes an outer cover layer whose thickness is 0.0575 inches, for a total ball diameter of 1.680 inches. Nesbitt 193, col. 3:39-40. I refer to this ball construction herein as BALL\_1. Twelve (12) samples of these balls were made at my direction.

18. The second golf ball construction used the Nesbitt 193 core material (CORE\_1), the Nesbitt 193 inner cover layer material (ICL\_1), and the Wu 673 outer cover layer material (OCL\_2). I directed Acushnet personnel to make the ball with a core diameter of 1.495 inches, an inner cover layer thickness of 0.035 inches, and an outer cover layer of 0.0575 inches. As set forth above, this is consistent with the description in Nesbitt 193. I refer to this ball construction herein as BALL\_2. Twelve (12) samples of these balls were made at my direction.

19. The third golf ball construction used the Nesbitt 193 core material (CORE\_1), the Nesbitt 193 inner cover layer material (ICL\_1), and the Molitor 751 outer cover layer material (OCL\_3). I directed Acushnet personnel to make the ball with a core diameter of 1.495 inches, an inner cover layer thickness of 0.035 inches, and an outer cover layer of 0.0575 inches. As set forth above, this is consistent with the description in Nesbitt 193. I refer to this ball construction herein as BALL\_3. Twelve (12) samples of these balls were made at my direction.

20. The fourth golf ball construction used the Nesbitt 193 core material (CORE\_1), the Molitor 637 inner cover layer material (ICL\_2), and the Molitor 637 outer cover layer material (OCL\_1). I directed Acushnet personnel to make the ball with a core diameter of 1.495 inches, an inner cover layer thickness of 0.035 inches, and an outer cover layer of 0.0575 inches. As set forth above, this is consistent with the description in Nesbitt 193. I refer to this ball construction herein as BALL\_4. Twelve (12) samples of these balls were made at my direction.

21. The fifth golf ball construction used the Nesbitt 193 core material (CORE\_1), the Molitor 637 inner cover layer material (ICL\_2), and the Wu 673 outer cover layer material (OCL\_2). I directed Acushnet personnel to make the ball with a core diameter of 1.495 inches, an inner cover layer thickness of 0.035 inches, and an outer cover layer of 0.0575 inches. As set forth above, this is consistent with the description in Nesbitt 193. I refer to this ball construction herein as BALL\_5. Twelve (12) samples of these balls were made at my direction.

22. The sixth golf ball construction used the Nesbitt 193 core material (CORE\_1), the Molitor 637 inner cover layer material (ICL\_2), and the Molitor 751 outer cover layer material (OCL\_3). I directed Acushnet personnel to make the ball with a core diameter of 1.495 inches, an inner cover layer thickness of 0.035 inches, and an outer cover layer of 0.0575 inches. As set forth above, this is consistent with the description in Nesbitt 193. I refer to this ball construction herein as BALL\_6. Twelve (12) samples of these balls were made at my direction.

23. The seventh golf ball construction used the Proudfit 187 core material (CORE\_2), the Proudfit 187 inner cover layer material (ICL\_3), and the Molitor 637 outer cover layer material (OCL\_1). I directed Acushnet personnel to make the ball with a core

diameter of 1.5 inches, an inner cover layer thickness of 0.0375 inches, and an outer cover layer of 0.0525 inches. This is consistent with the description in Proudfit 187. Specifically, Proudfit 187 describes a core and inner cover layer whose total diameter is 1.575 inches (which is consistent with a core whose diameter is 1.5 inches and an inner cover layer whose thickness is 0.0375 inches). Proudfit 187, col. 7:43-47. Proudfit 187 also describes an outer cover layer whose thickness is 0.0525 inches, for a total ball diameter of 1.680 inches. Proudfit 187, col. 7:43-47. I refer to this ball construction herein as **BALL\_7**. Twelve (12) samples of these balls were made at my direction.

24. The eighth golf ball construction used the Proudfit 187 core material (**CORE\_2**), the Proudfit 187 inner cover layer material (**ICL\_3**), and the Wm 673 outer cover layer material (**OCL\_2**). I directed Acushnet personnel to make the ball with a core diameter of 1.5 inches, an inner cover layer thickness of 0.0375 inches, and an outer cover layer of 0.0525 inches. As set forth above, this is consistent with the description in Proudfit 187. I refer to this ball construction herein as **BALL\_8**. Twelve (12) samples of these balls were made at my direction.

25. The ninth golf ball construction used the Proudfit 187 core material (**CORE\_2**), the Proudfit 187 inner cover layer material (**ICL\_3**), and the Molitor 751 outer cover layer material (**OCL\_3**). I directed Acushnet personnel to make the ball with a core diameter of 1.5 inches, an inner cover layer thickness of 0.0375 inches, and an outer cover layer of 0.0525 inches. As set forth above, this is consistent with the description in Proudfit 187. I refer to this ball construction herein as **BALL\_9**. Twelve (12) samples of these balls were made at my direction.

26. All golf balls made at my direction were made with a dimple pattern, and were painted and finished.

#### **TESTING OF GOLF BALLS**

27. I accompanied Acushnet personnel to an independent third-party plastics testing laboratory to provide the golf balls that were made at my direction for testing. The laboratory is called Plastics Technology Laboratories, Inc. (PTLI). I personally inspected the test equipment

that was to be used, and personally directed the lab technicians at PTLI as to the tests to be performed.

28. PTLI is accredited by the American Association for Laboratory Accreditation in the field of Mechanical Testing in accordance with the recognized International Standard ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories. PTLI is specifically accredited to perform the ASTM D2240 Durometer Hardness test.

29. I requested that PTLI conduct Shore D hardness measurements on the surface of the formed golf balls described above. Specifically the tests to be performed would be done in accordance with ASTM D2240, with the exception that the tests would be performed on the surface of the golf balls rather than on a plaque of material as required by ASTM D2240.

30. Prior to conducting the Shore D measurements, PTLI technicians conditioned the balls at 40+ hours at 23 degrees (+/- 2) Celsius and 50% (+/- 5%) Relative Humidity.

31. PTLI conducted Shore D hardness measurements on the balls I provided to them as I requested. For each ball specimen, PTLI took five readings on the Shore D scale between the dimples of the ball. For each ball specimen, these five readings were averaged. PTLI performed this process on all twelve samples of each ball construction, and provided for each ball construction an average Shore D hardness value for all twelve samples.

#### RESULTS OF TESTING

32. Each of the twelve ball specimens that were tested for each ball construction had an average cover hardness reading of below 64 Shore D. Each ball construction had an average cover hardness (over the twelve samples) of below 64 Shore D.

33. The following table sets forth the average Shore D hardness measurements (over the twelve samples) that were performed for each ball construction type:

Ball #	Core	Inner Cover Layer	Outer Cover Layer	Shore D
BALL_1	Nesbitt 193	Nesbitt 193	Molitor 637	62.0
BALL_2	Nesbitt 193	Nesbitt 193	Wu 673	56.0
BALL_3	Nesbitt 193	Nesbitt 193	Molitor 751	50.1 <sup>1</sup>
BALL_4	Nesbitt 193	Molitor 637	Molitor 637	61.0
BALL_5	Nesbitt 193	Molitor 637	Wu 673	55.6
BALL_6	Nesbitt 193	Molitor 637	Molitor 751	49.6
BALL_7	Proudfit 187	Proudfit 187	Molitor 637	59.4
BALL_8	Proudfit 187	Proudfit 187	Wu 673	56.8
BALL_9	Proudfit 187	Proudfit 187	Molitor 751	51.2

34. I am informed that PTLI has retained the ball samples that it tested, and they remain available for further testing if necessary. I am also informed that PTLI has retained the test results if needed.

I declare under penalty of perjury that the statements above are true and correct.

Date: May 29, 2007

  
 William J. MacKnight

<sup>1</sup> As I noted above, the outer cover layer material that was tested used a slightly harder Surlyn (1605, now 8940), than the Surlyn described in Example 4 of Molitor 751, so the hardness measurements using the outer cover layer material of Example 4 would be even softer than those set forth for Molitor 751 in this table.

IN THE UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF DELAWARE

CERTIFICATE OF SERVICE

I, David E. Moore, hereby certify that on June 1, 2007, a true and correct copy of the within document was caused to be served on the attorney of record at the following addresses as indicated:

VIA HAND DELIVERY

Thomas L. Halkowski  
Fish & Richardson P.C.  
919 N. Market Street, Suite 1100  
P. O. Box 1114  
Wilmington, DE 19899-1114

VIA ELECTRONIC MAIL

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/s/ David E. Moore  
Richard L. Horwitz  
David E. Moore  
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[dmoore@potteranderson.com](mailto:dmoore@potteranderson.com)

721875 / 30030

# Exhibit B

## To Dalton Declaration



Flexural Report Page 1 of 4

Testing : Flexural Properties Of Plastics  
 Test Method : ASTM D790-03 Procedure A  
 Project Number : P20071713  
 Customer : Acushnet Company  
 Attention : Troy Lester  
 Analyst : L. Howland  
 Date : May 22, 2007

Attachments : 1 Page Of Photos



Sample Preparation : Tested as received  
 Sample Dimensions : 0.497" x 0.128" x 6.00" (Average)  
 Sample Type : ASTM Flex Bar  
 Span Length (in) : 2.080  
 Cross-Head Speed (in/min) : 0.055  
 Span-To-Depth Ratio : 16±1:1  
 Radius Of Supports (in) : 0.197  
 Radius Of Loading Nose (in) : 0.197  
 Conditioning : 40+ hours at 23°C ± 2°C / 50% ± 5% RH  
 Test Conditions : 23°C ± 2°C / 50% ± 5% RH  
 Significance : ASTM D 790 specifies modulus and strength be reported to 3 significant figures

Sample Name	Test Number	Flexural Stress At 5% Strain (PSI)	Flexural Modulus (tangent *) (PSI)
MDI Prepolymer	1	596	13600
	2	473	11200
	3	573	13100
	4	523	12100
	5	536	12300
	Average	540	12500
	Std. Dev.	47	929
Estonia Blend	1	729	16900
	2	711	16100
	3	726	16600
	4	763	17600
	5	704	16100
	Average	727	16700
	Std. Dev.	23	627

\* = computer generated curve fit

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AC0131482

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 SUBJECT TO PROTECTIVE  
 ORDER



Flexural Report Page 2 of 4

Testing : Flexural Properties Of Plastics  
 Test Method : ASTM D790-03 Procedure A  
 Project Number : P20071713  
 Customer : Acushnet Company  
 Attention : Troy Lester  
 Analyst : L. Howland  
 Date : May 22, 2007



Sample Preparation : Tested as received  
 Sample Dimensions : 0.498" x 0.131" x 6.00" (Average)  
 Sample Type : ASTM Flex Bar  
 Span Length (in) : 2.080  
 Cross-Head Speed (in/min) : 0.055  
 Span-To-Depth Ratio : 16±1:1  
 Radius Of Supports (in) : 0.197  
 Radius Of Loading Nose (in) : 0.197  
 Conditioning : 40+ hours at 23°C ± 2°C / 50% ± 5% RH  
 Test Conditions : 23°C ± 2°C / 50% ± 5% RH  
 Significance : ASTM D 790 specifies modulus and strength be reported to 3 significant figures

Sample Name	Test Number	Flexural Stress At 5%	Flexural Modulus
		Strain (PSI)	(tangent *) (PSI)
8940	1	2180	50800
	2	2160	51200
	3	2160	50300
	4	2140	48100
	5	2170	50000
	Average	2160	50100
	Std. Dev.	15	1200
Texin Blend	1	267	5120
	2	268	5160
	3	264	5120
	4	247	4760
	5	282	5370
	Average	266	5100
	Std. Dev.	13	223

\* = computer generated curve fit

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